***United States Court of Appeals***

***for the Second Circuit***

# EXHIBITS

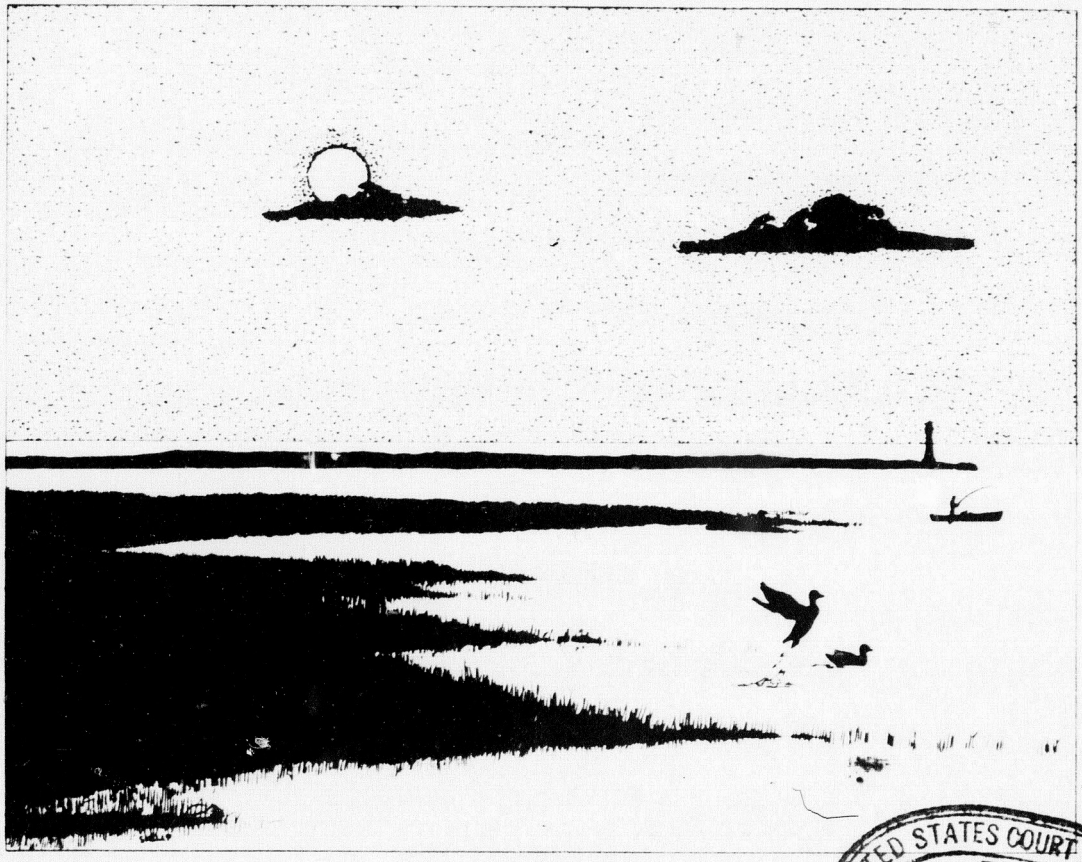
UNITED STATES
DEPARTMENT OF THE INTERIOR

76-6122

B

# FINAL ENVIRONMENTAL STATEMENT

## Volume 2 of 4



UNITED STATES COURT OF APPEALS
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SECOND CIRCUIT

Proposed
1976 OUTER CONTINENTAL SHELF
OIL AND GAS LEASE SALE
OFFSHORE THE MID-ATLANTIC STATES

## OCS SALE No. 40

Prepared by the
BUREAU OF LAND MANAGEMENT

Curt Berklund

Director

VOLUME 2

TABLE OF CONTENTS


| | | Page |
|---|---|---|
| III. | ENVIRONMENTAL IMPACTS OF THE PROPOSED ACTION | 1 |
| | A. Basic Assumptions Regarding Causes of Offshore Environmental Impacts of the Proposed Action | 1 |
| | 1. Impacts Resulting from Day-to-Day Operations Under Existing Operating Practices, Regulations, Economics and Technology | 3 |
| | a. Exploration | 3 |
| | b. Development | 9 |
| | c. Production | 12 |
| | d. Termination | 21 |
| | 2. Probability of Oil Spills in the Mid-Atlantic Region | 22 |
| | a. Pipeline Accidents | 25 |
| | b. Oil and/or Gas Well Blowouts | 27 |
| | c. Oil Spills Resulting from Explosions and Fires | 28 |
| | d. Tanker Accidents and Operations | 30 |
| | e. Natural Phenomena | 33 |
| | 3. Physical and Chemical Fate of Oil | 38 |
| | 4. Oil Spill Trajectories in the Mid-Atlantic Region | 56 |
| | B. Impacts of Offshore Oil and Gas Operations on the Natural Environment | 95 |
| | 1. Water Quality | 95 |
| | 2. Biological Communities | 104 |
| | a. Impact on the Plankton | 114 |
| | b. Impact on the Benthos | 129 |
| | c. Impact on the Fish | 145 |
| | d. Impact on Marine Mammals | 153 |
| | 3. Geological Hazard Impacts on Offshore Operations and Impacts of Offshore Operations on the Sea Floor | 157 |
| | 4. Air Quality | 164 |
| | C. Impact of Oil and Gas Operations on Man's Use of the Offshore Environment | 167 |
| | 1. Impact on Ports, Shipping, and Navigation | 167 |
| | a. Ports | 167 |
| | b. Shipping | 170 |
| | c. Navigation | 173 |
| | 2. Commercial and Sport Fisheries | 184 |
| | a. Commercial Fisheries | 184 |
| | b. Sport Fisheries | 190 |
| | 3. Possible Conflicts with Military Uses of the Mid-Atlantic Continental Shelf | 200 |
| | 4. Ocean Dumping | 201 |
| | 5. Offshore Archeological and Historic Sites | 205 |
| | 6. Impact on Future Ocean Mining | 206 |

7. Impacts of Mid-Atlantic Weather and Physical Oceanographic Conditions on Offshore Petroleum Operations . . . . . 208
D. Onshore Impact of Oil and Gas Operations . . . . . 216
1. Impact on Man's Use of the Environment . . . . . 216
a. Introduction . . . . . 216
b. Economic Impacts . . . . . 235
c. Population Impacts and Effects Upon the Infrastructure . . . . . 266
d. Land Use Impacts . . . . . 279
e. Impact on Recreation and Tourism . . . . . 292
f. Impact on Archeologic and Historic Sites . . . 309
g. Solid Waste . . . . . 310
h. Aesthetic Impacts . . . . . 313
2. Impacts on the Natural Environment . . . . . 316
a. Onshore Vegetation . . . . . 316
b. Beaches . . . . . 322
c. Marine and Coastal Birds . . . . . 323
d. Wildlife . . . . . 330
e. Water Quality . . . . . 336
f. Air Quality . . . . . 343
E. Proximity Evaluation . . . . . 253
F. Recapitulation of the Proximity Evaluation . . . . . 360
G. Summary Risk Analysis . . . . . 370
H. Cumulative Impact of the Proposed Sale and Other Federal Actions . . . . . 372
1. Additional OCS Oil and Gas Lease Sales . . . . . 372
2. Deepwater Ports . . . . . 379
3. Offshore Nuclear Generating Plants . . . . . 380
4. Ocean Dumping . . . . . 383
5. Dredging . . . . . 386

IV. MITIGATING MEASURES INCLUDED IN THE PROPOSED ACTION . . . 387
A. Federal Regulations and Enforcement . . . . . 387
1. Department of the Interior . . . . . 387
a. Bureau of Land Management . . . . . 387
b. U.S. Geological Survey . . . . . 389
2. Department of Transportation . . . . . 420
a. U.S. Coast Guard . . . . . 420
b. Materials Transportation Bureau . . . . . 421
c. Federal Aviation Administration . . . . . 422
3. United States Army Corps of Engineers . . . . . 423
4. United States Navy . . . . . 424
5. U.S. Environmental Protection Agency . . . . . 424
6. Federal Power Commission . . . . . 425
B. State Regulation . . . . . 426
1. Delaware . . . . . 426
2. Maryland . . . . . 427
3. New Jersey . . . . . 428

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4. New York . . . . . 429
5. Virginia . . . . . 430
C. Oil Spill Containment and Cleanup . . . . . 431
1. National Oil and Hazardous Substances Pollution Contingency Plan . . . . . 431
2. State Programs . . . . . 434
3. Existing and Proposed Private Oil Spill and Containment Capabilities in the Region . . . . . 438
4. OCS Operating Orders . . . . . 441
5. Status of Oil Spill Containment and Cleanup Technology . . . . . 442
D. Mitigations Included for Specific Aspects of the Proposed Action . . . . . 445
1. Offshore Structures and Pipelines . . . . . 445
2. Measures Involving Military Uses of the OCS and NASA Rocket Trajectories . . . . . 448
3. Onshore Facilities . . . . . 449
a. Terminal and Storage Facilities . . . . . 450
b. Onshore Operations Bases . . . . . 452
c. Gas Processing Plants . . . . . 453
d. Pipelines . . . . . 455
E. Special Stipulations . . . . . 458
1. Cultural Resources . . . . . 459
2. Biologically Important Areas . . . . . 461
3. Placement of Structures . . . . . 462
4. Shipping of Oil . . . . . 463
5. Pipeline Corridors . . . . . 464
6. Pipeline Burial . . . . . 464
7. Undetonated Explosives . . . . . 465
F. Other Mitigating Measures . . . . . 467
1. Notices to Lessees and Operators . . . . . 467
2. Waivers of OCS Orders . . . . . 469
3. Unitization of Producing Fields . . . . . 469
4. Geophysical Information Concerning Geological Hazards . . . . . 470
G. Uncommitted Mitigating Measures . . . . . 472

V. ADVERSE ENVIRONMENTAL IMPACTS WHICH CANNOT BE AVOIDED SHOULD THE PROPOSAL BE IMPLEMENTED . . . . . 474
A. Marine Organisms . . . . . 474
B. Vegetation . . . . . 474
C. Wildlife . . . . . 475
D. Wetlands . . . . . 476
E. Beaches . . . . . 477
F. Water Quality . . . . . 478
1. Offshore . . . . . 480
2. Onshore . . . . . 480
481

G. Air Quality . . . . . 482
1. Offshore . . . . . 482
2. Onshore . . . . . 483
H. Land Use . . . . . 484
I. Socioeconomic . . . . . 485
J. Recreation and Tourism . . . . . 489
K. Commercial and Sports Fisheries . . . . . 490
L. Shipping and Navigation . . . . . 491
M. Historical and Archeological Resources . . . . . 493

VI. RELATIONSHIP BETWEEN SHORT-TERM USES OF MAN'S ENVIRONMENT AND ENHANCEMENT OF LONG-TERM PRODUCTIVITY . . . . . 494

VII. IRREVERSIBLE AND IRRETRIEVABLE COMMITMENT OF RESOURCES . 498
A. Mineral Resources . . . . . 498
B. Land Resources . . . . . 498
C. Fish and Wildlife Resources . . . . . 499
D. Economic Resources . . . . . 500
E. Human Resources . . . . . 501
F. Archeological and Historical Resources . . . . . 501

VIII. ALTERNATIVES TO THE PROPOSED ACTION . . . . . 502
A. Hold the Proposed Sale in Modified Form . . . . . 502
1. Delete Tracts From the Proposal . . . . . 502
2. Substitute Tracts . . . . . 510
a. Within the Call for Nomination Area . . . . . 510
b. Outside the Call for Nomination Area . . . . 512
B. Delay the Proposed Sale . . . . . 516
1. Pending Implementation of Coastal Zone Management Plans . . . . . 516
2. Pending Completion of Studies Concerning Potential Environmental Impacts of Offshore Minerals Development . . . . . 520
3. Pending Development of New Equipment to Provide Increased Environmental Protection . . . . . 523
4. Pending Completed Implementation of Recommendations Made in Reports on OCS Operating Orders and Regulations and a Review of Regulations and Amendments as Necessary . . . . . 526
5. Pending Enactment of Legislation to Provide States With OCS Revenue Sharing and/or Compensation Funding . . . . . 528
6. Pending Enactment of Legislation to Establish An Oil Spill Liability Fund . . . . . 530
C. Withdraw the Proposed Sale . . . . . 532
1. Energy Conservation . . . . . 533
2. Conventional Oil and Gas Supplies . . . . . 537
3. Coal . . . . . 540
4. Nuclear Power . . . . . 549

5. Oil Shale . . . . . 553
6. Hydroelectric Power . . . . . 555
7. Solar Energy . . . . . 558
8. Oil Imports . . . . . 562
9. Natural Gas Imports . . . . . 564
10. Liquefied Natural Gas Imports . . . . . 566
11. Geothermal Energy . . . . . 567
12. Other Energy Sources . . . . . 569
13. Combination of Alternatives . . . . . 569
D. Alternative OCS Leasing Areas . . . . . 582
E. Alternatives Within the Proposed Action . . . . . 582
1. Government Exploratory Drilling Prior to Leasing 582
2. State Participation in Development Decisions . . 584

## III. ENVIRONMENTAL IMPACTS OF THE PROPOSED ACTION

### A. Basic Assumptions Regarding Causes of Offshore Environmental Impacts of the Proposed Action

As previously indicated, a total of 154 tracts are proposed to be leased for oil and gas exploration and development. These tracts are located from 47 to 92 miles off the coasts of New Jersey and Delaware. The amounts of undiscovered recoverable resources estimated by the USGS for the entire area are 0.4 to 2.6 billion barrels of oil and 2.6 to 12.8 trillion cubic feet of gas.[1] The higher end

---

[1]Estimates on the 154-tract area provided by the USGS in September 1975 were 0.4 to 1.4 billion barrels of oil and 2.6 to 9.4 trillion cubic feet of gas. However, estimates provided by the USGS on January 6, 1975, on the potential undiscovered resources contained in the entire Mid-Atlantic Baltimore Canyon Trough area were 3 to 5 billion barrels of oil and 15 to 25 trillion cubic feet of gas. The USGS estimates that the most promising 3.5 million acres of this entire Trough area could contain 80 percent of the recoverable resources, i.e., 3.2 billion barrels of oil and 16 trillion cubic feet of gas. In turn, of this 3.5 million acres, it was assumed that 2 million acres would be leased containing 2.6 billion barrels of oil and 12.8 trillion cubic feet of gas, while the actual area presently proposed for lease is 876,750 acres. Because this proposal is located in a frontier area in which no exploratory wells have been drilled, there is no assurance that there is petroleum available in commercial quantities. Therefore, the initial high estimate has been maintained and used as a high discovery case for some of the impact analysis made in this part of the statement. Actual impacts may therefore be less than described for this high case. Until drilling actually occurs, oil and gas resource amounts can be estimated only on the basis of the best geological and geophysical data available.

of this range represents a greater amount of resources than have been estimated most recently by the Geological Survey, on the basis of tracts included in this proposal. However, because this proposal is located in a frontier area in which no exploratory wells have been drilled, this higher range will be utilized for impact analysis purposes in discussions contained in this section of the statement and following sections as well.

Within the following sections, every effort has been made to quantify impacts which may result from this proposed sale. Where quantification has been possible, the range of estimates indicated above has been utilized. In addition, maximum variables have been used in measuring impact. For example, whereas it is estimated that pipeline burial disturbs 4000-8000 cubic yards of sediment per mile, 8000 cubic yards has been utilized in estimating potential maximum impact. Therefore, it should be kept in mind that all figures are relative to <u>maximum</u> impact, and do not take into account factors which would tend to moderate such impacts. Actual impact, in most cases, would probably be less than the maximum shown, and this has been indicated in the text in most cases. However, there are many areas in which quantification of impacts is not possible, because of lack of data, variability of factors affecting impact, and so forth.

This section will describe in detail those facets of the proposed action which could affect the offshore natural environment.[1] A further discussion and description of oil and gas operations is found in Appendix 4.

1. Impacts Resulting from Day-to-Day Operations Under Existing Operating Practices, Regulations, Economics, and Technology

a. Exploration

It is assumed that from 60 to 575 exploratory wells may be drilled in the Mid-Atlantic as a result of the proposed sale. The most active exploratory drilling takes place during the initial five years (leases are presently for five-year periods and can be extended for additional one-year periods, as set forth in 43 CFR 3302.2). The number of wells which might be drilled in the eventuality of no discovery cannot be determined. In some areas where "shows" have occurred, drilling has continued for over 5 years before discovery, resulting in several wildcat wells per tract. The average number of wells drilled per leased tract can vary from one to 7 or 8. In other areas, unfavorable shows (poor porsity low permeability, no indication of hydrocarbons) have resulted in rapid

[1]Refer to Table I-1 for a summary of activities related to the proposed action.

field abandonment with some tracts not even being tested. We expect that in the no discovery case the number of exploratory wells drilled would fall within the low range of wells anticipated for a discovery case (60 to 575).

Vessels for drilling exploratory wells would probably be brought from the Gulf of Mexico. Three types of rigs--jack-ups, semi-submersibles, and drillships--may be used. From 5 to 20 rigs are expected to be used at any one time in the exploratory phase. Once a drilling rig is in place and drilling commences, special muds are circulated through the wellbore to provide pressure control, lubrication of the drill bit, and removal of drill cuttings from the hole.

Using information provided by the USGS, it is assumed that the average well drilled in the Baltimore Canyon Trough will penetrate to a depth of 15,000 feet. Although hole sizes vary greatly, we are utilizing a hypothetical exploratory and development well size, indicated in Table III-1. Table III-1 also indicates the volume of cuttings generated by such a well. As the drilling fluid/drill cuttings mixture is circulated to the surface, drill cuttings (pulverized rock and sediment) are separated from the drilling fluid by shale shakers, desilters, and desanders and the cuttings are discharged overboard. Sediment containing oil will be washed to remove the hydrocarbons, the wash water will be shipped to shore, and the cuttings discharged to the marine environment.

Table III-1. Volume of Drill Cuttings Generated in a Hypothetical 15,000-foot Offshore Well

| Interval (feet) | Hole Sizes (inches) | Volume of Cuttings (barrels) | Weight of Cuttings (tons) |
|---|---|---|---|
| 0 - 900 | 26 | 597 | 238.5 |
| 900 - 3500 | 17-1/2 | 775 | 312.5 |
| 3500 - 10,000 | 12-1/4 | 950 | 382.5 |
| 10,000 - 15,000 | 8-5/8 | 361 | 146.0 |
| Total | | 2,683 | 1,079.5 |
| MAXIMUM CUTTINGS | 60 Wells | 160,980 | 64,770 |
| | 575 Wells | 1,542,725 | 620,713 |

With regard to potential physical impacts of cuttings, Zingula (Oral Testimony, Public Hearing, DES for Proposed OCS Lease Sale No. 40, 1976) states that the discharges are negligible and short lived:

> There is no hard and fast rule as to what the shape, thickness, or extent of accumulation (drill cuttings) will be. However, diver surveys and side-scan sonar records...have shown accumulations in the Gulf of Mexico to typically be approximately 150 feet in diameter, with the outline being circular, elongate,or star burst, depending on currents. Maximum elevation of these piles immediately after drilling a well appears to be less than three feet, thinning rapidly toward the edges. Side-scan sonar records of wellsites in the Gulf of Mexico and Santa Barbara Channel, several months after drilling has been completed present no definite "shadows," thus indicating that the height of the cuttings pile is less than 6 inches...It should be remembered that cuttings drift down as individual small chips and not as a solid blanket.

Drilling mud is comprised of sea water and commercial components. Table III-2 shows the common components of drilling mud used for an offshore well and Table III-3 gives a breakdown of the components used in a typical 15,000-foot well. Approximately 10 percent of the mud used for each well will be consumed, the bulk of this retained in the wellbore and a portion adhering to cuttings. Since drilling muds from exploratory wells become "contaminated" with microfossils (used for analysis) from the various stratigraphic units encountered, it is undesirable to recycle used mud to other exploratory wells; as standard operating procedure, these muds are discharged to the marine environment after obtaining a permit from EPA. Thus, between 41,490 and 397,613 tons of commercial mud are expected to be utilized in the exploratory phase as a result of this proposed sale, based on drilling 60 to 575 exploratory wells. This would mean a range of 37,341 to 357,852 tons of mud would be directly discharged into the marine environment upon approval of EPA.

A discussion of possible impacts and uptake of trace metals from drilling muds into the ecosystem is provided in Section III.B.2., Appendix 9, and EPA (1975c). The U.S. Geological Survey (Written Testimony, DES for Proposed OCS Lease Sale No. 40, 1976) stated that:

> Ferrochrome lignosulfonate serves as a highly efficient dispersant by reducing the attractive forces between clay particles. Chrome lignosulfonates prevent the swelling and viscosity development of bentonite more effectively than other thinners. Because of their effectiveness,

Table III-2 . Components of Drilling Muds Which May Be Discharged into the Sea

| Substance | Source | Use | Composition | Known Hazard |
|---|---|---|---|---|
| Attapulgite clay | Quarry | To cause gelling of salt water based muds | A light green magnesium-rich clay, quarried as "Fullers Earth" | None |
| Bentonite clay | Quarry | To cause gelling of freshwater based muds | A light-colored montmorillonitic clay; slippery sticky when wet; swells to 10-20 times its dry volume | None |
| Caustic soda | Electrolysis of sodium chloride brine | For pH control | Sodium hydroxide, NaOH | Corrosive in concentrated form; not harmful after mixing into mud at low concentration and allowed to react |
| Ferrochrome lignosulfonate | Digestion of wood by sulfonate process; removal of cellulose; reaction with chromium compounds | Dispersant and emulsifier | Ferrochrome salt of lignosulfonic acid; content: Fe - 2.6%, Cr - 3.0%, S - 5.5% | Possible chromium toxicity in pure form, none known from diluted form in muds |
| Organic polymer | Chemical process with plant starch, wood fiber as raw materials | Conditioner, texturizer | Starch, cellulosic derivatives | None |
| Proprietary defoamer | Soap making process | Defoamer | Aluminum stearate $Al(CH_3(CH_2)_{16})^3$ | None |

TABLE III-3 · MUD COMPONENTS USED IN SEAWATER - LIGNOSULFONATE SYSTEMS TO 15,000 FEET. WEIGHT IN POUNDS[1]

| Component | Interval 0-900 Feet | Interval 900-3500 Feet | Sub-total 3500 Feet | Interval 3500-10,000 Feet | Sub-total 10,000 Feet | Interval 10-15,000 Feet | Total 15,000 Feet |
|---|---|---|---|---|---|---|---|
| Barium Sulfate (Barite) | 3,000 | 3,000 | 6,000 | 529,000 | 535,000 | 625,000 | 1,160,000 |
| Bentonitic Clay | 10,000 | 10,000 | 20,000 | 36,000 | 56,000 | 9,000 | 65,000 |
| Attapulgite Clay | 5,000 | 5,000 | 10,000 | - | 10,000 | - | 10,000 |
| Caustic | 500 | 500 | 1,000 | 20,000 | 21,000 | 23,000 | 44,000 |
| Aromatic Detergent | | 1,000 | 1,000 | 2,000 | 3,000 | - | 3,000 |
| Organic Polymers | | 1,000 | 1,000 | 3,000 | 4,000 | - | 4,000 |
| Ferrochrome Lignosulfonate | | | | 26,000 | 26,000 | 69,000 | 95,000 |
| Sodium Chromate | | | | | | 2,000 | 2,000 |
| Totals | 18,500 | 20,500 | 39,000 | 616,000 | 655,000 | 728,000 | 1,383,000 (691.5 tons) |

(From U.S. Geological Survey)

[1] It is emphasized that these are "typical" values and quantities may vary by as much as 50 percent from well to well.

chrome lignosulfonate muds are used in the Pacific OCS and throughout the world. Operators will be using this type of mud in the Mid-Atlantic, not because drilling they are duplicating Gulf Coast practices, but because drilling muds are vital for well-control purposes and chrome lignosulfonate allows these muds to carry out these well-control functions in deep holes. Discharges of heavy metals are subject to EPA restrictions.

EPA has indicated (Written Testimony, DES for Proposed OCS Lease Sale No. 40, 1976) they may actually place restrictions on these discharges.

Since all sites occupied by drilling rigs must be avoided by fishing boats, this could result in the removal of some fishing grounds during the exploratory phase. Jack-ups and drillships remove two to five acres per structure, while semi-submersibles using 458 meter (1500 feet) anchoring radii would remove up to 162 acres each. If only the areally more extensive semi-submersibles were to be used, then from 810 to 3240 acres could be removed from fishing at any one time. However, we anticipate total fishing grounds removed will probably be much less since vessels other than semi-submersibles most probably will be used in the Mid-Atlantic proposed sale area.

b. Development

If oil and gas are discovered as a result of this proposed sale, fixed platforms may be installed offshore. Technology presently exists to install platforms in water depths which would be encountered as a result of this proposed sale.[1] However, the

[1]Occidental Petroleum has installed a producing platform in 149 meters (474 ft) of water in the North Sea, Exxon is presently building one for 259 meters (850 ft) of water in the Santa Barbara Channel, and Shell Oil is constructing two platforms for use in 300 meters (1000 ft) of water in the Gulf of Mexico.

possibility does exist that subsea completions might be used as a result of this sale. Subsea completion units consist of a wellhead a a distance from a platform connected to the platform by flowlines. If these units were used they would result in sea floor obstructions that could foul trawling gear or ship anchors. The potential for damage to the assembly causing uncontrollable flow is reduced somewhat because of the strength and durability of the material that is used in sea floor completions, and OCS Orders requiring redundant safety devices and the marking of subsea systems to prevent such accidents.

Concrete platforms have been developed for use in the North Sea to counter a set of conditions. A combination of these conditions sufficient to induce use of concrete platforms is not thought to be present in the Mid-Atlantic. These are: 1) a number of areas of hard rock bottoms which pilings for steel platforms could not penetrate, 2) deep waters (generally over 100 m (300 ft), 3) physical conditions which it was originally felt would require such large amounts of steel so as to make steel platforms much more costly than usual, 4) giant petroleum fields, and 5) the intention in many cases to transport production by tanker. L. Boston (Written Testimony, Public Hearing, DES for Proposed OCS Lease Sale No. 40, 1976) stated that:

> It would be premature to state whether concrete structures will be economically used on the East Coast of the U.S. However, preliminary economics studies indicate that concrete platforms would be more economical than steel only when large storage volumes are required. The extremely high cost of this type structure effectively limits its use to very high production rates, for situations where the produced oil will be shipped by tanker. The problem is further complicated by the dispostion of any natural gas which is produced along with the crude oil.

Due to a combination of the following factors: 1) the anticipated field sizes for the Mid-Atlantic OCS; 2) the availability of fabrication facilities which can produce steel platforms and the suitability of steel platforms; 3) the expected use of pipelines; and 4) the relatively shallow water depths for this proposed sale, we do not anticipate the use of concrete platforms or storage tanks. A description of those types of facilities is included in Appendix 4.

After exploratory drilling has ascertained oil and gas finds, platforms are installed, and one or two drilling rigs would be placed on each platform to drill production wells. For purposes of our analysis, it is estimated that as a result of this proposal there may be from 200 to 880 development wells drilled from 10 to 50 platforms. It is also assumed that a maximum of 5 to 20 drilling rigs will be working at any one time to drill these wells.

Since all sites occupied by production platforms must be avoided by fishing boats, this could result in the removal of some fishing grounds. Each platform occupies a site of two to five acres. Therefore, a maximum (assuming 5 acres/platform) of 50 to 250 acres might become off limits for fishing because of platforms installed as a result of this proposed sale. The sites would be usable again once platforms are removed, after termination of production.

Paleontological information from development wells is not as critical as that from exploratory wells. As a consequence, drilling muds are recycled from one well to another and the only loss is the approximate 10 percent consumed, as explained in subsection a. above.

Using the drill hole dimensions discussed previously, Table III-4 details the cuttings released and muds which will be retained in the wellbore or adhere to cuttings from development wells.

Table III-4. Drill Cuttings and Muds for Development Wells

| | | |
|---|---|---|
| **Total Cuttings:** (Introduced to Marine Environment) | | |
| 200 Wells | 536,600 barrels | 215,900 tons |
| 880 Wells | 2,361,040 barrels | 949,960 tons |
| **Total Mud:** (Retained in Wellbore or Adhering to Cuttings) | | |
| 200 Wells | | 13,830 tons |
| 880 Wells | | 60,852 |

c. Production

The production platform contains all the equipment and performs the same function as a field gathering station does at onshore locations. For purposes of this statement, it is assumed that all development wells will be used for production. Average daily production ranging from 43,000 to 285,000 barrels per day could result from the amounts of recoverable resources estimated by the USGS. As previously indicated, production is expected to be conducted from 10 to 50 platforms. From 0.4 to 2.6 billion barrels of oil and 2.6 to 12.8 trillion cubic feet of gas are assumed to be produced over a 25-year field life.

When oil and gas are produced, waters associated with oil and gas pools are often produced also. These waters are called formation waters. In some pools, water is produced with the oil in early stages of production, whereas in others, appreciable water is never produced with oil over the field life.

Most formation waters are brines, characterized by an abundance of chlorides, mostly as sodium chloride, and have concentrations of dissolved solids several times greater than that of seawater. The total amount of mineral matter commonly found dissolved in oil-field waters ranges from a few milligrams per liter (mg/l), nearly freshwater, to approximately 300,000 mg/l, a heavy brine.[1] However, a common range is generally from 80,000 to 100,000 mg/l. Table III-5 shows the concentrations of suspended solids and trace or heavy metals from a variety of production areas. It is highly unlikely that any of the produced formation water resulting from this proposed sale would ever be piped ashore. Both economic and environmental considerations weigh heavily towards choosing to treat and release the water into the ocean at the platform site or to reinject it into subsurface formations. Reinjection is utilized

[1]This high figure (from Illinois Basin production) is quite rare.

Table III-5 MEDIAN CONCENTRATIONS OF TRACE METALS IN PRODUCED WATERS[a)]

Median concentration (equaled or exceeded by 50% of the samples) in each area[1]

| | Number of samples | Total solids (median) (g/l) | Co | Cr | Cu | K | Li | Mg |
|---|---|---|---|---|---|---|---|---|
| Illinois Basin | 22 | 98 | ND | 2p | 10p? | 300 | 15 | 6,000 |
| Louisiana and Texas Gulf Coast | 79 | 69 | ND | <1p | <25p | 300 | ND | 250 |
| East Texas | 88 | 66 | ND[2] | ND | < 1 | <50 | ND | 250 |
| North Texas | 24 | 222 | ND | <1p | 150p | 300 | ND | 5,000 |
| West Texas and New Mexico | 148 | 111 | ND | 2p | 1p | 350 | 15 | 1,000 |
| Permian only | 74 | 143 | ND | 2p | 2p | 400 | 10 | 1,000 |
| Pennsylvanian only | 34 | 115 | ND | 3p | < 1p | 300 | 10 | 1,000 |
| Silurian-Devonian only | 15 | 55 | ND | 2p | 4p | 300 | 10 | 400 |
| Ordovician-Cambrian only | 21 | 67 | ND | <2p | 4p | 400 | 15 | 800 |
| Anadarko Basin[3] | 118 | 137 | ND | 10p | 10p | 250 | 10 | 1,550 |
| Williston Basin, post-Paleozoic | 25 | 59 | <5p | <2p | <25p | 300 | ND | 250 |
| Williston Basin, Paleozoic | 55 | 173 | ND | 3p | 3p? | 800 | 35 | 600 |
| Powder River Basin | 22 | 5 | <5p | <2p | <25p | 300 | ND | 40 |
| Other Wyoming | 28 | 5 | ND | ND | ND | 300 | ND | 100 |
| Colorado | 18 | 5 | <5p | ND | <25p | 300 | ND | 30 |
| California | 116 | 18 | ND | 5p | 5p | 45 | ND | 90 |
| Seawater | - | 35 | 0.27p | 0.04p-0.07p | 1p-15p | 380 | 0.1 | 1,272 |
| Estimated Detection Limit | - | - | 1p | 1p | 1p | 50 | 2 | 10 |

| | Mn | Ni | Sn | Sr | Ti | V | Zr |
|---|---|---|---|---|---|---|---|
| Illinois Basin | 175p | ND | < 1p | 300 | <10p | ND | <10p |
| Louisiana and Texas Gulf Coast | 3.5 | <1p | < 1p | 15 | <10p | ND | <10p |
| East Texas | 3.3 | <1p | 3p | 350 | ND[2] | ND[2] | ND |
| North Texas | 45 | 15p | 12p | 450 | 7p? | ND | <10p |
| West Texas and New Mexico | 1.8 | <1p | < 1p | 200 | <10p | ND | ND |
| Permian only | 1.7 | <1p | < 1p | 90 | <10p | <1p | ND |
| Pennsylvanian only | 2.8 | <1p | < 1p | 300 | <10p | <1p | ND |
| Silurian-Devonian only | 300p | <1p | 1p | 90 | <10p | ND | ND |
| Ordovician-Cambrian only | 400p | <1p | 1p | 250 | <10p | ND | ND |
| Anadarko Basin[3] | 5.6 | 6p | 2p | 300 | <10p | <1p | <10p |
| Williston Basin, post-Paleozoic | 300p | <3p | < 1p | 100 | ND | <1p | ND |
| Williston Basin, Paleozoic | 660p | ND | < 1p | 95 | <10p | <1p | ND |
| Powder River Basin | 450p | <3p | < 1p | 25 | <10p | <1p | <10p |
| Other Wyoming | 300p | ND | < 1p | 20 | <10p | <1p | ND |
| Colorado | 300p | <3p | <10p | 20 | <10p | <1p | <10p |
| California | 950p | 10p | 2.5p | 10 | <10p | <1p | ND |
| Seawater | 1p-10p | 5.4p | 3p | 13 | Present | 0.3p | ND |
| Estimated Detection Limit | 1p | 1p | 1p | 16 | 10p | 1p | 10p |

a) Taken from Rittenhouse, Fulton, Grabowski, and Bernard

1 ND = below detection limits; p = concentration in parts per billion, otherwise parts per million.

2 No data; less sensitive methods of analysis used.

3 Includes Oklahoma Platform and Ardmore Basin.

Source: "Environmental Aspects of Produced Waters from Oil and Gas Extraction Operations in Offshore and Coastal Waters, prepared by OOC, Sept., 1975.

where feasible as a secondary recovery technique by pumping formation water, under pressure, back into the lower levels of the petroleum-producing zone. This method of disposal requires a separate well plus some water treatment to insure that the injected water is compatible with the host reservoir. Formation water which is to be discharged into the ocean is first passed through a water-treating facility that removes all but traces of entrained oil. However, the water is still void of dissolved oxygen and contains large quantities of dissolved minerals.

Under the Federal Water Pollution Control Act of 1965 as amended in 1972, the recently issued EPA Effluent Pollution Guidelines,[1] and proposed OCS Orders, the design of formation and other waste water treatment systems will limit the average oil content of discharged effluent to 30 ppm.

Although any estimate of the amount of produced formation water resulting from this proposed sale is difficult to estimate prior to exploration, it is assumed for this proposal that one barrel of water will be produced for every barrel of oil produced. According to the USGS

[1] Federal Register, September 15, 1975. 40(179):42543-42551 and Federal Register, September 15, 1975. 40(179):42572-42577.

(Written Testimony, DES for Proposed OCS Lease Sale No. 40, 1976), primary water production varies from 20 percent to 150 percent of oil production volume, with maximum production of water occurring at the end of a given reservoir's life. For the USGS estimate of peak production of oil at 90,000-320,000 bbls/day, a reasonable peak formation water production value might be 300,000 bbl/day. In the high case (very large find) a maximum peak of 740,000 barrels (31 million gallons) of formation water would be discharged daily adjacent to platforms. This would amount to a maximum of 930 gallons of oil (at EPA maximum of 30 ppm) introduced daily into the marine environment during peak production.

Depending on the physical and chemical properties of the formation waters as well as receiving waters, it is anticipated that the brines will become well mixed in the water column within a few days of discharge. The impacts resulting from the anoxic formation water are therefore expected to be short-term (actual time depending upon mixing/dilution rates) and localized.

Solvents which are used primarily to clean equipment on mobile rigs and platforms pose no significant threat to the OCS environment, since any solvent that is spilled on the platform is collected by curbs, gutters, drains, or drip pans. The drainage is then treated in a gravity separator or transferred to the production treatment system. Discharges must meet EPA oil and grease limitations.

Sewage treatment and disposal on offshore rigs and platforms is very similar to a holding and settling tank, but with the addition of a chlorination system. In this case the system is normally a fiberglass container somewhere on the platform into which all toilet, kitchen, and laundry drains discharge. The usual settling and bacterial digestion takes place in the tank and the final effluent is chlorinated. OCS Orders require that the effluent contain 50 ppm or less of biochemical oxygen demand (BOD), 150 ppm or less of suspended solids, and have a minimum chloride residual of 1.0 mg/l after a minimum retention time of fifteen minutes. (The chloride residual standards also comply with EPA regulations--USGS is amending sewage discharge standards to comply with EPA standards.) As in every other instance in which chlorination is used as a method of disinfection, the potential exists for the generation of trace quantities of chlorinated compounds that may be harmful to organisms. However, the effects of such trace quantities are only now beginning to be investigated. In comparison to values found in certain rivers the quantities generated at offshore platforms are considered totally insignificant. method of disposal is eminently more favorable than the present r. discharge methods of most passenger, cargo, and fishing vessels which pass through the area.

It is anticipated that all oil and gas produced as a result of this proposed sale will be transported to shore by pipeline (special stipulation, Section IV.E.), though a possibility exists that tankers might be used. Oil and gas would be carried in separate pipelines, having

first been separated on platforms offshore. Small gathering lines would collect production from platforms, gathering at central points where larger pipelines (24 to 36 inches diameter) would carry production in corridors. It is assumed that from one to four corridors would be established from offshore points to onshore facilities (2 pipelines per corridor). Offshore pipelines (assuming four pipelines) would traverse from 100 to 570 miles of sea bottom.

The expense of pipeline burial, coupled with implications for the marine environment should a major break occur, have combined to dictate conservative design, emplacement, and operating procedures. Under a stipulation proposed for this proposed sale (Section IV.E.), all pipelines will be buried (when technically and economically feasible as determined by the USGS Area Oil and Gas Supervisor). The burial depth will be determined on a case-by-case basis by the Supervisor.

While up to 570 miles of large diameter pipeline may be required, some portions may not be buried; i.e., those sections where burial may not be required by the Supervisor; sections of the gathering system[1] around groups of platforms where burial may not be required; and sections in State waters where the Interior Department has no jurisdiction and cannot require burial.[2] However, individual States

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[1]It should be noted that gathering lines tend to sink or be covered in sediments by themselves due to their small diameter.

[2]The Materials Transportation Bureau (Office of Pipeline Safety Operations) recently proposed standards for offshore pipeline facilities which may alleviate this concern (40 Federal Register 43740).

may develop requirements in the near future for burial in offshore State waters.

Pipeline burial is effected by jetting sediment away from underneath the pipeline and allowing it to sink into the resulting trench. The equipment used in this operation consists of a work barge equipped with high/volume pressure water pumps and air compressors. From the barge a multiple membered towline, consisting of a strength member, water line, and air line, extends downward to a U-shaped structure which straddles the pipeline and glides along it on rollers. Affixed to the U-shaped jetting device are several nozzles which direct water and air, under high pressure, ahead and below the pipeline. Sediments are blasted out of the narrrow trench by the water jets, partially lifted by the air, and deflected to the sides by various types of fins. The suspended sediments fall diffusely along either side of the trench. As the jetting device is pulled forward, the pipeline settles into the trench and is partially buried quite soon by the reworked sediment as it slips and settles back into the depression. Complete burial and restoration of original bottom contours may require additional time. Valves are normally shrouded to protect them from damage. In shallow waters, experience has shown contour restoration to be quite rapid, whereas in deeper waters, more than a year may be required. During pipeline burial, large volumes of sediment are disrupted and resuspended for a short time in overlaying waters. As the width of the trench varies with

the compactness and fluidization point of the sediment, we can only estimate volumes of disturbed sediment. For example, if a trench is 5 feet deep and 6 to 12 feet wide, and a parabolic cross-section is assumed, the pipeline would disturb approximately 4000-8000 cubic yards of sediment per mile, some of which would be resuspended.

If all pipelines were to be buried, based on 100 to 570 miles of pipeline, we estimate a maximum of 800,000 to 4,560,000 cubic yards of sediment will be resuspended (assuming the maximum 8000 cubic yards of sediment disturbed per pipeline mile). It can be assumed that due to the large extent of sand cover on the Continental Shelf, the disturbed sediment put into suspension will be mostly sand which will settle to the sea floor adjacent to the pipeline in a relatively short time.

Section III.D.1.a. includes a discussion of pipeline land falls and onshore pipelines.

If it should not be technically and/or economically feasible to bring production ashore by pipelines, tankers may have to be used.[1] It is thought that tankers in the range of 30,000 to approximately 70,000 dead weight tons would be utilized if use of tankers should become necessary, although it is most likely that they will fall on

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[1]Factors which could hinder or prohibit the use of pipelines in this Mid-Atlantic area might include the following: 1) volume of resources found uneconomic for pipeline transport, 2) distribution of geologic structures proven capable of economic production of oil and gas are widespread in relation to each other, and 3) receptivity of State and local jurisdictions along Mid-Atlantic coast to the approval of pipeline landfalls that would be needed.

the low side of this range. Tankers of this size are presently used to ship oil to existing Mid-Atlantic refinery terminals. Transportation of oil directly from the production site to terminals would be expected, due to the relatively short distance, thereby avoiding an lightering operations.

d. Termination

According to industry estimates, with proper placement of wells and sufficient pipeline capacity, a gas reservoir could be drained in as little as 10 years. In contrast, some oil reservoirs have been producing for over 20 years. When a reservoir has been depleted to a level at which it cannot be profitably produced, operations are terminated.

OCS Orders[1] require wells to be plugged, the casing severed well below the mudline, the platform removed, and all obstructions cleared from the area. Major trunklines may be used for

[1] See Chapter IV and Appendix 11.

future production from adjacent areas, but smaller lines would probably be abandoned in place. Abandonment consists of purging the lines of entrained hydrocarbons by water flushing (the water disposed of onshore) and severing the ends below the mud line. The necessity for removal of pipelines nearshore is usually regulated by the State. Removal of nearshore pipelines has been completed in isolated cases in other OCS operating areas.

2. Probability of Oil Spills in the Mid-Atlantic Region

Operational activities in the Northern Gulf of Mexico appear to be the most representative of anticipated offshore oil and gas operations in the Mid-Atlantic region. It is acknowledged, however, that the physical environments of these two areas are not exactly alike. It has been thought that heavier seas and more difficult winter conditions increase the probability of oil spills by human error or fatigue of structures, though statistical data from the North Sea (a more severe operating area than the Mid-Atlantic) are not available to support this observation. The USGS (Written Testimony, DES for Proposed OCS Lease Sale No. 40, 1976) stated that in harsher weather environments operating equipment and personnel programs are designed accordingly, and that no significant pollution incidents have occurred in the drilling of about 700 wells in the North Sea.

In an effort to extrapolate oil spills for the proposed sale area, operational spills statistics for the Gulf of Mexico have been used (Table III-6) due to the fact that they represent the most comprehensive and extensive spill record in regard to exploration, production, and the declining phases of OCS oil field development for the United States.

The most important feature of oil spill statistics as reported by the CEQ (1974) is the size of individual spills. The statistics represent oil spills of all types ranging in size from a few gallons to several thousands of barrels. Most spills are at the low end of this range. For example, in 1972, 96 percent of the spills were less than 24 barrels (1000 gallons) and 85 percent were less than 2.4 barrels (100 gallons). A few very large spills account for most of the oil spilled. The Torrey Canyon accident of 1967, for example, spilled twice as much crude oil as was reported spilled in the United States in 1970. In 1970 and 1972, three spills each year accounted for two-thirds of all the oil spilled in the United States navigable waters in those years. Because the total volume spilled per incident can vary by factor of one million, it is more or less meaningless to estimate average amounts of oil that might be spilled during the life of any field (Devanney and Stewart, 1974b). Data supplied by the U.S. Geological Survey, for the period of 1956-1974 in the Gulf of Mexico, indicates a total of 43 oil spill incidents connected with Federal OCS oil and gas operations. The statistics for pipeline breaks and leaks, however, are only for the period 1967-1974.

TABLE III 6. GULF OF MEXICO OIL SPILL STATISTICS

| Year | Number of Wells Drilled | Number of Blowouts | Number of Spills | Volume Spilled (in bbls) | Number of Explosions & Fires | Number of Spills | Volume Spilled (in bbls) | Number of Pipeline Breaks & Leaks | Number of Spills | Volume Spilled (in bbls) | Total Number of Incidents | Total Number of Spills | Total Volume Spilled (in bbls) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1956 | 230 | 1 | 0 | 0 | 0 | 0 | 0 | | | | 1 | 0 | 0 |
| 1957 | 322 | 1 | 0 | 0 | 0 | 0 | 0 | | | | 1 | 0 | 0 |
| 1958 | 304 | 1 | 0 | 0 | 1 | 1 | minimal | | | | 2 | 1 | 25 |
| 1959 | 278 | 1 | 0 | 0 | 1 | 0 | 0 | | | | 2 | 0 | 0 |
| 1960 | 403 | 2 | 0 | 0 | 2 | 0 | 0 | | | | 4 | 0 | 0 |
| 1961 | 461 | 0 | 0 | 0 | 1 | 0 | 0 | | | | 1 | 0 | 0 |
| 1962 | 453 | 1 | 0 | 0 | 1 | 0 | 0 | | | | 1 | 0 | 0 |
| 1963 | 537 | 1 | 0 | 0 | 0 | 0 | 0 | | | | 2 | 0 | 0 |
| 1964 | 680 | 7 | 2 | 100<br>5,180 | 1 | 1 | 2,559 | | | | 8 | 3 | 7,839 |
| 1965 | 799 | 5 | 2 | 1,688<br>minimal[1/] | 0 | 0 | 0 | | | | 5 | 2 | 1,713 |
| 1966 | 817 | 2 | 2 | minimal<br>minimal | 1 | 1 | minimal | | | | 3 | 3 | 75 |
| 1967 | 854 | 1 | 0 | 0 | 4 | 3 | minimal<br>minimal<br>minimal | 2 | 2 | 65<br>160,639 | 7 | 5 | 160,779 |
| 1968 | 931 | 6 | 1 | minimal | 1 | 0 | 0 | 1 | 1 | 6,000 | 8 | 2 | 60 |
| 1969 | 826 | 2 | 2 | minimal<br>2,500 | 5 | 0 | 0 | 4 | 4 | 100+[3/]<br>342<br>7,532<br>50 | 11 | 6 | 10,574 |
| 1970 | 823 | 2 | 2 | 53,000<br>minimal | 9 | 2 | 30,500<br>100 | 1 | 1 | 50 | 12 | 5 | 83,675 |
| 1971 | 806 | 5 | 1 | 450 | 14 | 0 | 0 | 2 | 2 | 70<br>80 | 21 | 3 | 600 |
| 1972 | 839 | 3 | 1 | minimal | 29 | 1 | minimal | 1 | 1 | 100 | 33 | 3 | 150 |
| 1973 | 816 | 3 | 1 | minimal | 26 | 0 | 0 | 1 | 1 | 5,000 | 30 | 2 | 5,025 |
| 1974 | 807 | 5 | 2 | 75<br>200 | 22 | 3 | minor[2/]<br>0<br>1 | 3 | 3 | 19,833<br>100<br>2,213 | 30 | 8 | 22,541 |
| Total 19 Years | 11,986 | 49 | 16 | 63,393 | 118 | 12 | 33,429 | 15[4/] | 15[4/] | 202,199[4/] | 182 | 43 | 299,021 |

1/ For spills reported as minimal, meaning less than 50 barrels, value of 25 barrels assigned. See text for explanation.
2/ For spills reported as minor, meaning less than 238 barrels, value of 119 barrels assigned. See text for explanation.
3/ For spills reported as 100+ barrels, value of 125 barrels assigned. See text for explanation.
4/ For period of eight years.

Also, if both blowouts and explosions and fires were given as the cause of a spill, it was assumed that the blowout was the primary cause with the explosions and fires being a result of the blowout. Finally, although there are other types of operations-related oil spill incidents, according to the data supplied, all possible accidents have been included under one of the three major categories: blowouts; explosions and fires; and pipeline accidents.

The estimated total volume of oil spills from Federal OCS operations during this period (1956-1974) as a result of these various incidents is approximately 299,021 barrels. Table III-6 presents on a yearly basis the number of incidents resulting in oil spills, and the volume of oil spilled for each incident in the Gulf of Mexico.

a. Pipeline Accidents

Spillage analysis for this proposed sale is projected from the Gulf of Mexico data which has the longest Federal OCS statistical record available. Upon examining Tables III-7 through III-9, it is seen that pipeline breaks and leaks account for only 8.24 percent of the accidents but 34.88 percent of the spills and 67.62 percent of oil spilled. Since new regulations[1] concerning pipelines went into effect in 1970, these percentages have experienced a change. Since 1970, pipeline breaks and leaks accounted for only 6.35 percent of the accidents, 38.10 percent of the spills, but only 24.51 percent of the oil spilled. Due to these new regulations, oil spilled by pipeline accidents accounts for approximately

[1]USGS OCS Operating Order No. 9, Oil and Gas Pipelines.

Table III-7 Accidents (1956-1974)

Number of OCS Accidents from:

| | | |
|---|---|---|
| Blowouts | -- 49 | 26.92% |
| Explosions and Fires | --118 | 64.84% |
| *Pipeline Breaks and Leaks | -- 15 | 8.24% |
| Total | --182 | 100.00% |

Table III-8 Spills (1956-1974)

Number of OCS spills from:

| | | |
|---|---|---|
| Blowouts | -- 16 | 37.21% |
| Explosions and Fires | -- 12 | 27.91% |
| *Pipeline Breaks and Leaks | -- 15 | 34.88% |
| Total | -- 43 | 100.00% |

Table III-9 Volume of Oil Spilled (1956-1974)

Volume of OCS oil spilled from:

| | | Barrels | |
|---|---|---|---|
| Blowouts | -- | 63393 | 21.20% |
| Explosions and Fires | -- | 33429 | 11.18% |
| *Pipeline Breaks and Leaks | -- | 202199 | 67.62% |
| Total | -- | 299021 | 100.00% |

*(1967-1974)

0.00145 percent of the total production (approximately 1.9 billion barrels) in the Gulf of Mexico. Assuming the high case, that from 0.4 to 2.6 billion barrels of oil could be produced from this proposed sale, this rate of spillage, from 5800 to 37,700 barrels of oil might be spilled as a result of pipeline malfunctions during the expected 25-year life of these fields. However, due to improved technology and stricter regulations, much lower spillage rates

might be expected from this proposed sale. However, we are unaware of any methodology for predicting spills which would take into account the differences between fisheries trawling activity in the Gulf of Mexico and in the Mid-Atlantic. It is expected that mitigating measures prepared especially for this proposed sale (Section IV, especially E.) will reduce the probability of trawler door collisions with pipelines.

Of all the oil spilled by pipeline breaks and leaks (from 1967-1974), 92.31 percent of the total volume spilled and 33.33 percent of the accidents are believed to be a direct result of a ship dragging its anchor across a pipeline (U.S. Department of the Interior, 1974), thereby causing it to repture. Since the new regulations of 1970, these percentages have changed to 72.92 percent and 37.50 percent, respectively. By examining these figures, it becomes quite obvious that although anchor dragging-related accidents account for approximately one-third of the total accidents, they account for a large portion of the total volume of oil spilled. The requirements to bury pipelines in the Mid-Atlantic OCS area, which is proposed, should reduce this risk in this heavy ship traffic area.

b. Oil and/or Gas Well Blowouts

If the various control systems on a well should fail, the well might blow out of control and could release large quantities of oil into the marine environment. If, on the other hand, a gas well blows out, the escaping gas will either burn or disperse into the atmosphere, producing no water pollution.

Gulf of Mexico statistics indicate that one blowout occurs for approximately every 245 wells drilled, spilling an "average" of about 1294 barrels of oil. This is not technically correct, however, because the Shell Oil fire which accounted for 83.5% of the spillage occurred during workover operations (USGS, Written Testimony, DES for Proposed OCS Lease Sale No. 40, 1976).
It should also be noted that not one pollution incident of greater than 50 barrels has resulted from a drilling blowout since 1969 (USGS, Ibid.).

Since the Mid-Atlantic region is a frontier area where no previous offshore drilling has occurred, the subsurface pressures are unknown and estimates of how many blowouts could occur is sheer speculation. However, using the above "averages," since it is assumed that a minimum of 60 and a maximum of 1455 wells (exploratory and development) will be drilled as a result of this proposed sale, it can be assumed that there might be approximately 0.2 to 6 blowouts which could result in a maximum "average" of 7685 barrels of oil being spilled over the 25-year life of these fields.

c. Oil Spills Resulting from Explosions and Fires

Combustible hydrocarbon liquids or vapors making contact with arcing electrical or overheated mechanical devices undoubtedly cause most explosions and fires. More rarely they are ignited by lightning or static electricity. Sometimes,

explosions and fires involve the accidental ignition of fuel, solvent, or heat exchanger fluids.

If producing wells are damaged so that oil flows freely and ignites, they are usually allowed to burn while remote control operations are underway. In this way, most hydrocarbon liquid expelled by the well burns, reducing the fire hazard during relief operations and lowering ocean pollution levels. If a blowing well is releasing mostly natural gas, ocean pollution is minimal. Personnel and the platform or drilling structure are, however, imperiled in the event of a fire.

From 1956-1974, many explosions and fires of varying sizes have occurred in the Gulf of Mexico during OCS production. Most of the fires were extinguished without causing serious damage or pollution.

Of the 118 recorded explosions and fires, only 12 resulted in oil spills amounting to a total of 33,429 barrels. When these explosions and fires are compared to the number of wells drilled, it is found that one explosion and/or fire occurs for every 101.5 wells drilled, spilling an average of 283.3 barrels of oil. Since it is assumed that a minimum of 60 and a maximum of 1455 wells will be drilled as a result of this proposed sale, it can be assumed that there might be approximately 0.6 to 14 explosions and/or fires which could result in a maximum "average" of 4057 barrels of oil being spilled.

d. Tanker Accidents and Operations

Tanker accidents, carelessness, or mismanagement release almost 36.5 million barrels of oil annually into the world's oceans (Charter et al., 1973). About 98 percent of all the oil spilled by vessels is from incidents over 1000 barrels (CEQ, 1974). Most large tanker spills occur nearshore (within 50 miles of land) when a vessel runs aground, rams a fixed structure, or collides with another vessel.

If pipelines are found to be technically or economically not feasible or if rights-of-way are denied in State waters, tankers may have to be used as a result of this proposed sale rather than pipelines. Because Mid-Atlantic OCS oil would serve to replace importation of foreign oil by tankers, the volume of crude oil handled by Mid-Atlantic facilities (refineries, ports) would remain the same. We may expect, as well, that levels of tanker spills, if tankers are used, for the Mid-Atlantic region would only increase incrementally. Incidence of bilge discharge although prohibited by the U.S. Coast Guard and EPA, could increase because vessels would only be traversing the continental shelf (not the deep ocean basins beyond where this practice is presently carried out by tankers in foreing commerce).

The only means presently available to calculate the percentage of oil which might be spilled as a result of tankering from offshore platforms is on the basis of worldwide tanker spills versus volume of oil carried. No methodology is available to our knowledge which

predicts tanker spills assuming only U.S. vessel use. In our opinion the existing method is invalid for use in the Mid-Atlantic because of: 1) the relatively small size of ships which would be employed (30,000 to 70,000 dead weight tons (dwt) or smaller); 2) only United States vessels and personnel will be used, with better overall performance records; 3) spills are compiled from tanker operations (port-to-port, barging, lightering) that most probably would not be employed in the Mid-Atlantic; and 4) 84 percent of the worldwide spillage is attributed to tank washing without load-on-top systems, whereas new U.S. Coast Guard regulations will require load-on-top systems. (New regulations also require segregated ballasts in tankers over 70,000 dwt; however, use of vessels of this size to transport any Mid-Atlantic OCS-produced oil is not anticipated due to channel restrictions at existing terminals.)

Using the methods and assumptions developed for worldwide tanker spill statistics,[1] the following volumes (Table III-10) hypothetically might be spilled by tankers carrying all Mid-Atlantic OCS crude oil produced over a 25-year period, based on the USGS estimates, as a result of this proposed sale. However, we emphasize that we do not feel this will be done, but instead that pipelines

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[1] Methodology for developing these statistics may be found in the Final EIS for Proposed OCS Lease Sale No. 35 (Southern California), Vol. 2, pp. 50-75. This methodology adapted for the Mid-Atlantic area is available in the BLM New York OCS Office.

will be used. Moreover, due to the circumstantial nature of this type of oil spill, we emphasize that it is not believed that this worldwide spill/volume methodology is directly applicable or meaningful for projecting amounts of crude oil that might be spilled in the Mid-Atlantic area as a result of this proposal for the reasons given above. Nor does this methodology take into account that this OCS oil transported would be replacing existing imports of foreign crude into the Mid-Atlantic area. Further discussion is provided in Section III.D.1.

Table III-10. Hypothetical Tanker Spillage Summary by Loss Category (25-year field life)

| Category | Percent spilled/ Volume oil carried | Oil Spilled 0.4 billion bbl Produced | Oil Spilled 2.6 billion bbl Produced |
|---|---|---|---|
| Bilges, leaks, and bunkering | 0.000050 | 20,000 bbl | 130,000 bbl |
| Casualties | 0.000160 | 64,000 | 416,000 |
| Casualties less Structural failures | 0.000090 | 36,000 | 234,000 |
| Terminal Operations | 0.0000022 | 880 | 5,720 |
| Dry docking | 0.000369 | 147,600 | 959,400 |
| Tank washing (without load on top system) | 0.0035 | 1,400,000 | 9,100,000 |
| Total | .00417 | 1,668,480 bbl | 10,845,120 bbl |

e. Natural Phenomena

The preceding sections dealt with estimates on the volume of oil that may be spilled annually as a result of human error and/or equipment failure. This section is devoted to oil spill probability estimates due to natural phenomena in the proposed sale area. It is taken, with minor changes, from the CEQ (1974) report which estimates the likelihood of natural phenomena damaging or destroying an offshore structure. Estimates were not based on past experiences in offshore oil operations because the environmental conditions of the Mid-Atlantic region differ from previous experience so that estimates based on past experience have marginal value. The CEQ, therefore, used an analytical approach considering design criteria, safety specifications of the structure, and likelihood of a particular event.

Major offshore structures are designed to withstand environmental stress specified by the contracted owner or operator. Typically, forces associated with the 100 year storm have been the specified stress. There is always a chance, however, that these forces could be exceeded, resulting in an oil spill. For example, over a 30-year field life, the probability of at least one storm occurring with forces exceeding the 100 year storm is 26 percent and with forces exceeding the 200 year storm 14 percent.

Based on several assumptions, the CEQ calculated the number of times oil spills can be expected to occur due to natural phenomena. It was assumed that: each severe natural occurrence is independent of the others; the probability of the occurrence is small so that the Poisson distribution applies; the probability that a natural event will occur is adequately described by the recurrence relations given in other sections of the CEQ report; structural designers can develop designs which will withstand the forces of specific natural events, and a specific natural event will occur in the vicinity of an oil field exposing the structures to the full forces associated with the event.

Unprotected wells can blow out if the platform collapses, either from excessive storm forces or earthquakes. The probability of a

storm exceeding the design storm has been calculated for design specifications of both 100 and 200 year storms with safety factors of 1.5 and 2.0. It was presumed a design spectrum for earthquakes having Richter magnitudes of 6.6, 7.2, and 8.5 could be developed. The analysis further assumed that the platform would experience the full effects of a storm or earthquake exceeding the design spectrum. If a platform collapses, the conductor pipes will shear. The positive open control lines to the subsurface valve will also shear, however, thus closing the valve and preventing the loss of oil. The valves, however, are not 100 percent reliable and recent tests only show a 0.96 to 0.97 reliability. The CEQ used 0.96 for their calculations. A valve reliability of 0.99 was also used in order to show how improved reliability would reduce failure rates. Table III-11 summarizes the estimates.

Upon examining Table III-11, several important points are readily observed. First, the likelihood of platform collapse has a linear increase as the age of the field increases and a linear decrease as the design storm criteria is increased. The second important point is that platforms used in the Mid-Atlantic OCS must be able to withstand the maximum recorded earthquake on the Mid-Atlantic coast if the likelihood of collapse is to be no greater than that for severe storms during the field life. Table III-11 also lists the likelihood of damage caused by having a tsunami occur during a severe storm.

TABLE III-11. ESTIMATE OF PLATFORM COLLAPSE AND WELL BLOWOUT (SAFETY VALVE RELIABILITY = 0.96 and 0.99)

| | Age of field in years | | | Remarks |
|---|---|---|---|---|
| | 20 | 30 | 40 | |
| **Severe Storm Design Standard** | | | | |
| 100 yr storm | | | | |
| Margin of Safety - 1.5 | .09/.0036/.0009* | .14/.0056/.0014 | .19/.0076/.0019 | Average number of times severe storms will cause well blowout |
| Margin of Safety - 2.0 | .04/.0016/.0004 | .07/.0028/.0007 | .08/.0032/.0008 | |
| 200 yr storm | | | | |
| Margin of Safety - 1.5 | .05/.002/.0005 | .07/.0028/.0007 | .09/.0036/.0009 | |
| Margin of Safety - 2.0 | .02/.0008/.0002 | .03/.0012/.0003 | .04/.0016/.0004 | |
| **Earthquake design** | | | | |
| M = 6.6 | | | | |
| Atlantic $M_s$ - 1.5 | .25/.01/.0025 | .38/.015/.0038 | .51/.02/.0051 | Average number of times earthquakes will cause well blowout |
| Atlantic $M_s$ - 2.0 | .23/.009/.0023 | .35/.014/.0035 | .46/.018/.0046 | |
| M = 7.2 | | | | |
| Atlantic $M_s$ - 1.5 | .10/.004/.0010 | .16/.064/.0016 | .21/.008/.0021 | |
| Atlantic $M_s$ - 2.0 | .09/.0036/.0009 | .14/.056/.0014 | .18/.007/.0018 | |
| **Combined Severe Storm and Tsunami** | | | | |
| 100 yr storm | .001/.00004/.00001 | .0015/.00006/.000015 | .002/.00008/.00002 | |
| 200 yr storm | .0005/.00002/.000005 | .0007/.000028/.000007 | .001/.00004/.00001 | |

*(Platform Collapse/Well Blowout R = 0.96/Well Blowout R = 0.99)

(Adapted from CEQ, 1974)



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At this point, the likelihood of oil spillage from damaged storage systems due to natural phenomena shall be examined. There are three types of storage facilities: onshore, floating, and underwater. It has previously been assumed, however, that only onshore storage facilities will be used in the Mid-Atlantic region. It is now required, by government regulations, that dikes enclose all onshore storage tanks so that, if the tank fails, the released oil will be unable to escape from the area. It is maintained by the CEQ, therefore, that the chance of an oil spill due to natural phenomena is zero provided the dikes are not damaged. Damage to dikes is very dependent on the quality of the soil foundation, and therefore, it is extremely important that a thorough geologic investigation of the proposed site be made in order to confirm that the soil properties are satisfactory.

With regard to the likelihood of natural phenomena damage to pipelines, if pipelines are properly designed, constructed, and emplaced, they are relatively insensitive to all natural phenomena except ground faulting and slumping along the pipeline routes. The possibility of soil stability loss will be assessed when a thorough geologic analysis of the possible routes has been made and a valve location program selected. These steps are taken during the late stages of the exploration program and follow the decision that the reservoir contains oil and/or gas in sufficient quantities to warrant pipeline transportation.

pipeline transportation. For this reason, the likelihood of pipeline spills due to natural phenomena cannot be predicted at this time.

Table III-12 summarizes the effects of each of the natural elements, the volume of oil at risk, and the caveats regarding certain of the evaluations.

3. Physical and Chemical Fate of Oil

Petroleum is made up of thousands of hydrocarbon, nitrogen, sulfur, oxygen, and trace metal components, of which hydrocarbons form the greatest percentage. These hydrocarbons are in turn composed of different subgroups based upon their structure; paraffins (alkanes), cycloparaffins (naphthenes), aromatics, and naphtheno-aromatics. The designation of any petroleum substance as gasoline, fuel oil, or crude oil depends on the relative percentages of the above mentioned fractions and the nitrogen, sulfur, and oxygen (NSO) compounds it contains. Table III-13 illustrates this variability of components among different crudes and distillation products, and a further breakdown of crudes is presented in Table III-14.

The various types of petroleum enter the marine environment via natural and human-related pathways as shown in Table III-15.

Once entrained, the petroleum is subject to many different physical, chemical, and biological processes that modify the original composition. These include spreading, evaporation, dissolution,

Table III-12 . Summary of the Effect of Natural Phenomena on Various Elements of the Oil Production System

Natural Phenomena

| Element | Severe Storm | Earthquake Vibration | Earthquake Soil Stability | Tsunami | Volume of Oil at Risk Per Event |
|---|---|---|---|---|---|
| Platform | Slight | Slight[1] | Slight[2] | None | 500 to 1500 bbl /well/day |
| Pipeline | None | None | Variable[3] | None | 10,000 bbl or more |
| Onshore Storage | Slight[4] | Slight[5] | Slight[2] | None | Up to 1,000,000[6] bbl or greater |

[1]Provided earthquake resistant design features are used.

[2]Provided careful soil analysis program is followed.

[3]The avoidance of slump, faulted, or poorly consolidated sediments can reduce potential impacts

[4]Provided tanks are sited away from flood prone areas.

[5]Provided free surface effect is reduced.

[6]Dikes give protection against damaging oil spill.

(Adapted from CEQ, 1974)

Table III-13. Estimated Percent Composition by Weight for Various Petroleum Substances[1]

| Subgroups | Heavy Crude | Average Crude | #6 Fuel Oil[2] (Bunker C) | #2 Fuel Oil[3] | Gasoline | Kerosene |
|---|---|---|---|---|---|---|
| Paraffins | 10% | 30% | 15% | 30% | 50% | 35% |
| Cycloparaffins | 45% | 50% | 45% | 45% | 40% | 50% |
| Aromatics | 25% | 15% | 25% | 25% | 10% | 15% |
| NSO | 20% | 5% | 15% | 0 | 0 | 0 |

[1]Adapted from the National Academy of Sciences, 1975.

[2]#6 Fuel Oil (Bunker C) is used for fueling ships.

[3]#2 Fuel Oil is used for home heating.

Table III-14. Basic Data for Crude Oils[1]

| Fraction | Description | % by Weight in Crude Oil | Boiling Point (°C) | Molecular Weight | Vapor Press @ 20°C (mm) | Solubility ($gm/10^6 gm$ Distilled $H_2O$) |
|---|---|---|---|---|---|---|
| 1 | Paraffin $C_6$-$C_{12}$ | .1-20 | 69-230 | 86-170 | 110-.1 | 9.5-.01 |
| 2 | Paraffin $C_{13}$-$C_{25}$ | $0^+$-10 | 230-405 | 184-352 | .1 | .01-.004 |
| 3 | Cycloparaffin $C_6$-$C_{12}$ | 5-30 | 70-230 | 84-164 | 100-1. | 55-1. |
| 4 | Cycloparaffin $C_{13}$-$C_{23}$ | 5-30 | 230-405 | 156-318 | 1.-0 | 1.-0 |
| 5 | Aromatic (Mono- and di-Cyclic) $C_6$-$C_{11}$ | 0-5 | 80-240 | 78-143 | 72-.1 | 1780.-0. |
| 6 | Aromatic (Poly-Cyclic) $C_{12}$-$C_{18}$ | $0^+$-5 | 240-400 | 128-234 | .1-0 | 12.5-0 |
| 7 | Naphtheno-Aromatic $C_9$-$C_{25}$ | 5-30 | 180-400 | 116-300 | 1.-0 | 1.-0 |
| 8 | Residual (including Heterocycles) | 10-70 | >400 | 300-900 | 0 | 0 |

[1]Adapted from Moore et al. (1973) and Moore et al. (1974).

Table III-15. Petroleum Hydrocarbons Introduced into the Oceans[1]

| Source | Input Rate (mts)[2] | |
|---|---|---|
| | Best Estimate | Probable Range |
| Natural seeps | 0.6 | 0.2-1.0 |
| Offshore production | 0.08 | 0.08-0.15 |
| Transportation | | |
| LOT tankers | 0.31 | 0.15-0.4 |
| Non-LOT tankers | 0.77 | 0.65-1.0 |
| Dry docking | 0.25 | 0.2-0.3 |
| Terminal operations | 0.003 | 0.0015-0.005 |
| Bilges bunkering | 0.5 | 0.4-0.7 |
| Tanker accidents | 0.2 | 0.12-0.25 |
| Nontanker accidents | 0.1 | 0.02-0.15 |
| Coastal refineries | 0.2 | 0.2-0.3 |
| Atmosphere | 0.6 | 0.4-0.8 |
| Coastal municipal wastes | 0.3 | - |
| Coastal, Nonrefining, industrial wastes | 0.3 | - |
| Urban runoff | 0.3 | 0.1-0.5 |
| River runoff | 1.6 | - |
| TOTAL | 6.113 | |

[1]Adapted from National Academy of Sciences, 1975.

[2]Million metric tons.

biodegradation, emulsification, oxidation, and sedimentation (Figure III-1). The rates of each are determined by the nature of the spilled oil and the temperature, nutrient level, light intensity, winds, currents, particulate matter, and so on that exist at the time. This constant removal and transformation process is called "aging" or "weathering," and the final residue depends upon the original starting material and the conditions of the sea and atmosphere during its sojourn. The actual rates for most of these processes have not been determined due to difficulties in designing experiments which would generate accurate, unbiased data and in measuring certain parameters during actual spills (Feldman, 1973). Until these rates and the relationships among the processes are determined, the actual fate of a particular petroleum species cannot be predicted with certainty. However, based on present knowledge, estimates of the composition of the slick over time can be made.

As it reaches the air-sea interface from either above or below the surface, petroleum begins to spread. The initial momentum generated by the blowouts, spills, or other causes is the original impetus behind the spreading effect. When this energy is dissipated, viscosity and surface tension forces take over (Hoult, 1972). Although most pure hydrocarbons do not spread spontaneously, certain aromatic and very low molecular weight (LMW) paraffins do (Shafrin and Zisman, 1967). These, in conjunction with the surface-active NSO compounds,

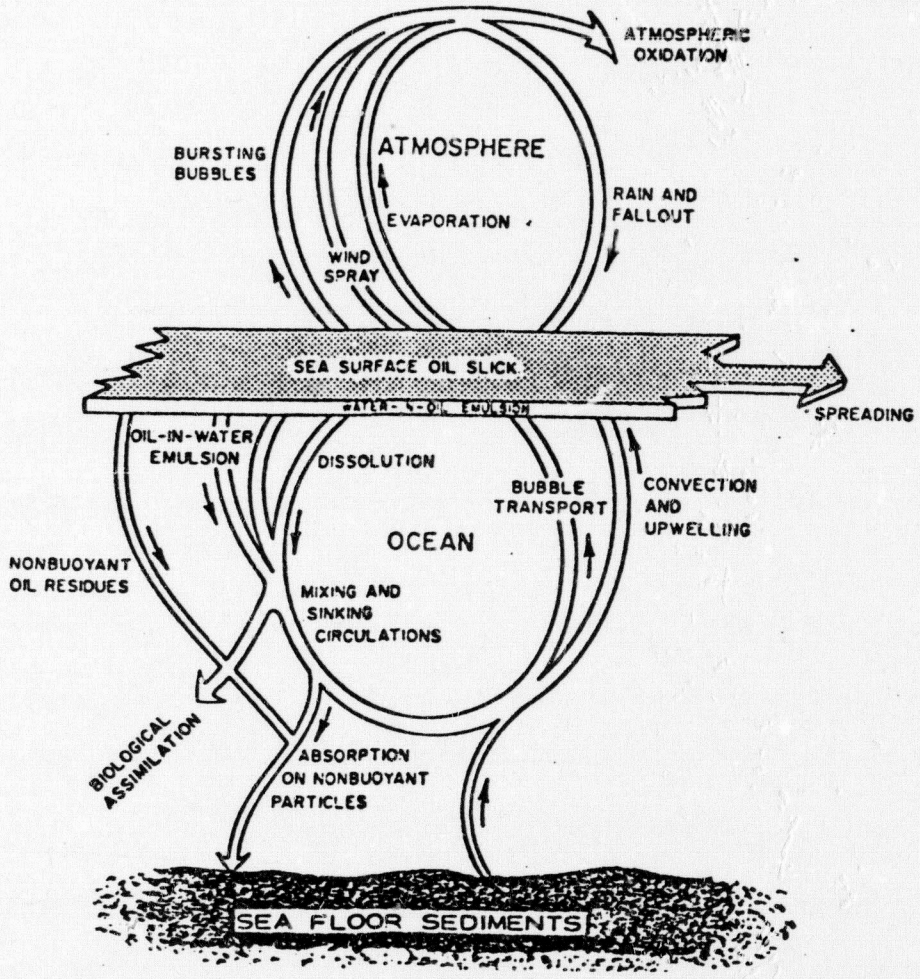


Figure III-1. Natural Forces Which Disperse and Modify Petroleum Slicks on Water (Adapted from Garrett, 1972)

continue to spread the oil (NAS, 1975) until they are lost, by evaporation or dissolution, or removed from contact with the water, as within a tar ball. Light fuel oils and distillates, containing a high percentage of the LMW paraffins and aromatics, spread rapidly or 'flash,' while heavier fuel oils containing smaller percentages of the above, spread very little after the initial momentum is exhausted (Berridge et al., 1968a; MacIntyre et al., 1974). Spreading is not necessarily symmetrical. Under the influence of wind, waves, and currents, the slick becomes elongated in the direction of the prevailing winds (Phillips, 1966) and thick patches of oil interspersed in larger areas of thin film are formed (Jeffery, 1973). These oil patches may be as much as three orders of magnitude thicker than the surrounding film (Lassiter et al., 1974). Jeffrey (1973) experimentally spilled 120 tons (approximately 30,000 gallons or 800 barrels) of Iranian Light Crude Oil on the sea surface. (According to the MIT (1974) study statistics for noninland oil industry related spills, this is greater than 99 percent of all spills, Table III-16.) After four days he reported that most of the oil had disappeared and only patches of rapidly disappearing oil remained (Figure III-2 and Figure III-3).

Spreading is also a 'self-retarding' phenomenon (Berridge et al., 1968a). As it increases the surface area of the slick, it accelerates the rate of change so that the original oil becomes more dense and viscous and finally ceases to spread (Berridge et al., 1968a; NAS,

Table III-16. Volume Distribution Comparison of Non-inland Oil Industry Related Spills (MIT, 1974)

| Gallons | 1971 | 1972 |
|---|---|---|
| 0 - 1 | 2497 | 2387 |
| 1 - 10 | 1526 | 2020 |
| 10 - 100 | 2146 | 2509 |
| 100 - 1000 | 1000 | 1068 |
| 1K - 10K | 222 | 232 |
| 10K - 100K | 53 | 54 |
| 100K - 1M | 16 | 14 |
| 1M - 10M | 1 | 3 |
| >10M | 0 | 0 |
| | 7461 | 8287 |

Table III-17. Evaporative Losses from a Crude Oil as a Function of Time (Kreider, 1971)[1,2,3]

| Carbon Number | 1 Day (%) | 2 Days (%) | 3 Days (%) | 4 Days (%) | 7 Days (%) | 10 Days (%) | 21 Days (%) |
|---|---|---|---|---|---|---|---|
| 12 | 98 | 100 | 100 | 100 | 100 | 100 | 100 |
| 13 | 75 | 91 | 98 | 100 | 100 | 100 | 100 |
| 14 | 38 | 52 | 80 | 92 | 100 | 100 | 100 |
| 15 | 12 | 18 | 40 | 55 | 84 | 95 | 100 |
| 16 | 1 | 2 | 15 | 27 | 52 | 74 | 88 |
| 17 | 0 | 0 | 5 | 11 | 25 | 40 | 58 |
| 18 | 0 | 0 | 0 | 0 | 8 | 24 | 35 |
| 19 | 0 | 0 | 0 | 0 | 5 | 13 | -- |
| 20 | 0 | 0 | 0 | 0 | 0 | 3 | -- |

[1]Kolpack, 1974.

[2]Interpreted from a graph.

[3]Film thickness 0.5 mm.

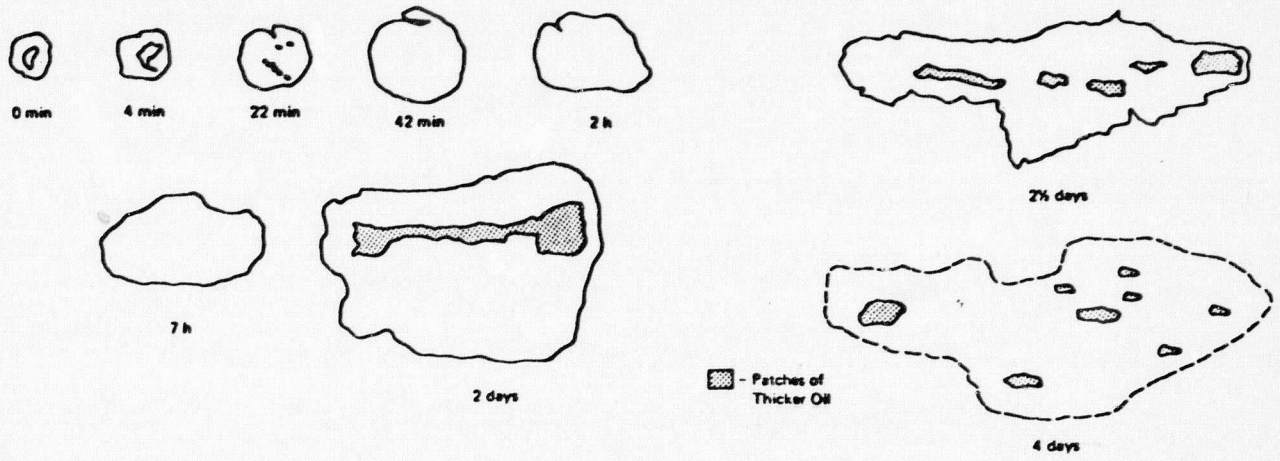


Figure III-2 . Hypothetical Diagrams Showing Development and Breakup of the Oil Slick (Jeffery, 1973)

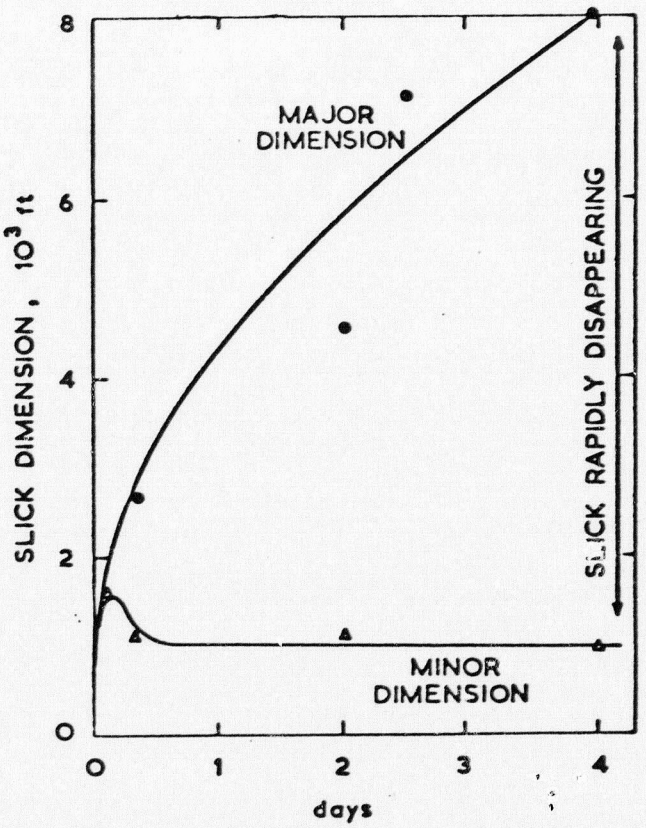


Figure III-3 . Changes in Slick Dimensions Over Time as Applied to Figure III-2 (Jeffery, 1973)

1975). The remnants of the original slick are then separated or broken into smaller fragments and dispersed in the sea.

When petroleum substances are first exposed to the atmosphere, evaporation is the predominant process (Berridge et al, 1968a). Assisted by strong wind and wave action, this mechanism produces significant changes in the petroleum's composition. It has been demonstrated in simulated field experiments with crude oil (Kreider, 1971) that the majority of hydrocarbons of 12 carbons or less (boiling point <230°C) are lost within the first 24 hours and that most of those of 15 carbons or less are lost within 10 days, Table III-17. This would account for approximately 50 percent of the average crude oil and an even larger percentage of the lighter fuel oils and distillates (Table III-13). MacIntyre et al. (1974) in actual field experiments using #2, #4 and #6 fuel oils in volumes of 60-200 gallons (approximately 1-6 barrels) showed similar losses during the first hours as did Sivadier and Mikoloj (1973) using natural seep oil.

In later experiments Kreider (1971) demonstrated that thin films weather more quickly than thicker patches, as shown in Figure III-4. Since much of the work done in this area has been either simulated field or laboratory experiments, the results of Smith and MacIntyre (1971) should be noted. Comparing losses of #2 fuel oil components in a laboratory bubbler apparatus and in the field, they found that losses of LMW hydrocarbons were significantly greater in the field (Table III-18).

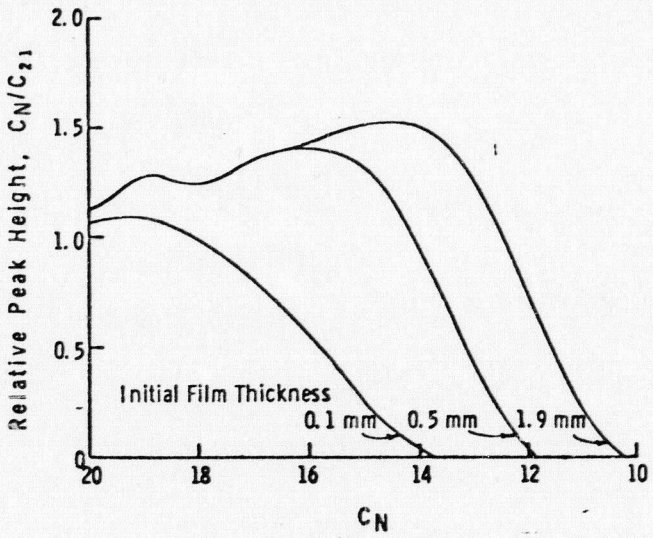


Figure III-4.

Table III-18. Evaporative Losses from a #2 Fuel Oil

| Carbon Number | 6 hr, 5°C[1] (Percent) | Bubbler, 40 hr, 25°C[2,3] (Percent) |
|---|---|---|
| 10 | 96 | 81 |
| 11 | 85 | 46 |
| 12 | 58 | 20 |
| 13 | 44 | 6 |
| 14 | 7 | 0 |
| 15 | 6 | 0 |

[1]Wind 1-18 knots.

[2]Film thickness 0.5 mm.

[3]2 Liters per min. air.

Loss of these LMW paraffins and aromatics implies the loss of the more toxic components of oil (Blumer, 1969, 1971; Anderson, 1975). After the lower molecular weight hydrocarbons have evaporated, the rate of loss by evaporation stabilizes (Blumer et al., 1973). High molecular weight (HMW) hydrocarbons in the $C_{15}$-$C_{25}$ range (boiling points 230° - 400°C) evaporate much more slowly while those greater than $C_{25}$ (boiling points >400°C) scarcely evaporate at all and remain in the slick subject to modification by other processes. As a result of this change, the original oil becomes more dense (Berridge et al., 1968a; Sivadier and Mikolay, 1973) and the specific gravity of crudes and heavier fuel oils approaches that of sea water (1.025). If this occurs, the oil achieves a state of near neutral buoyancy and enters the water column via wave action or attachment to existing particulate matter. Dissolution preferentially removes the LMW aromatics and paraffins (McAuliffe, 1966; NAS, 1975) and is in "competition" with the evaporative loss of these components. These compounds exhibit a wide range of solubilities: benzene - 1780 gm/$10^6$gm water, toluene - 515 gm/$10^6$gm water, hexane - 9.5 gm/$10^6$gm water (McAuliffe, 1966) and are responsible for the more immediate toxic effects suffered by the local biota (Blumer, 1969, 1971; Anderson, 1975; NAS, 1975). The HMW aromatics are less soluble, but these may be the compounds responsible for the long-term chronic effects (Blumer et al., 1970, 1972). Other processes, such as oxidation or biodegradation, generate alcohols, phenols, sulfoxides, and so

on, that are more soluble than the original components (Berridge et al., 1968a; Zobell, 1950).

Dissolution is therefore a longer term mechanism that continues operating throughout the existence of a spill even after evaporation has stabilized.

Bacteria are widely distributed over the oceans especially in areas in which oil has been spilled (Kolpack et al., 1973). Once considered nuisances because they attacked refined petroleum products, these bacteria now seem particularly useful when oil becomes a nuisance (Boesch et al., 1974). By converting hydrocarbons to carbon dioxide or other products that may be more soluble in sea water, they eliminate a great deal of the oil residue. Normal paraffins are the most readily degraded components, followed by branched - and cyclo-paraffins and aromatic hydrocarbons (Blumer and Sass, 1972a, 1972b). This preferential loss of normal paraffins leads to a decrease in the "stickness" of the original oil (Kator et al., 1971).

Biodegradation or microbial utilization is dependent on the nutrient level (nitrogen and phosphorous) and dissolved oxygen content of the water. It is therefore more effective in estuaries than in the open ocean and is very slow once the oil has been incorporated into the sea floor or beach sands (Blumer and Sass, 1972a, 1972b). It is also a "surface" phenomenon which implies that the larger patches of oil are more slowly degraded than the smaller tar balls. Much slower

than most of the other processes, biodegradation is the mechanism for destruction of the residue that remains after all other processes are exhausted.

As oil spreads into thin films and thicker patches, the thicker patches begin to take up water at different rates (hours or days) dependent on the type of oil (Dodd, 1971). This leads to the formation of water-in-oil emulsions or, with the addition of surfactants or emulsifiers, oil-in-water emulsions. The water-in-oil emulsions are formed naturally at sea (Smith, 1968; Berridge et al., 1968a) by the surfactants contained in the heavier fractions of oil; therefore, crude oils and heavier fuel oils will form this type of emulsion, whereas lighter fuel oils and distillates will not. This type of emulsion leads to the "chocolate mousse" formations, containing 80 percent water, found after some spills (Berridge et al., 1968; Smith, 1968; Jeffery, 1973) and the various other concentrations of water-in-oil. By increasing the actual volume of the spilled oil, emulsification accelerates the other processes of evaporation, dissolution, and biodegradation, and the density of the remaining oil therefore increases. Under the influence of wave action, the larger patches are broken up and can produce the ubiquitous tar balls found in the ocean (Bulter et al., 1973; Butler, 1975; NAS, 1975). Those discovered on the open ocean have been determined to have come from one source and have been estimated to remain a year or more (Butler et al., 1973). Those found on beaches are sometimes

aggregations of several smaller tar balls from different sources (NAS, 1975).

Oil-in-water emulsions are formed by additions of surfactants or emulsifiers and consist of very small particles of oil dispersed in vast amounts of sea water. This type of emulsion is easily dispersed throughout the water column by wave and current action and accelerates the other processes of degradation by increasing the surface area.

Auto-oxidation and photo-oxidation are two other processes that generate more soluble products from the original components (Zobell, 1964; Berridge et al., 1968a). They can be catalyzed or inhibited by trace metals or other components of the oil: for example, vanadium catalyzes oxidation while sulfur stops it by forming sulfoxide (Dodd, 1971). Here again exact rates are not known, but Freegarde and Hatchett (1970), using light sources resembling sunlight, have estimated that by photolysis alone the time for decomposition of a 2½ µg slick is 100 hours. This is equivalent to 2000 $kg/km^2$ or approximately 1300 $gal/mi^2$ (Garrett, 1969).

The remaining process is sedimentation. As the LMW hydrocarbons evaporate and dissolve and the HMW are degraded, the oil residue becomes more dense. When its specific gravity approaches that of sea water, it may be more easily sunk either by agglomeration onto existing particular matter or by wave action which carries the near

neutral buoyancy residue deeper into the water column or forces it into the bottom sediments. Waves and currents may also carry the residue onto beaches where it is either incorporated into the sand or carried out to sea on the next waves. Once oil is spilled, either in sediments or sands, the rates of change are much slower (Blumer and Sass, 1972a, 1972b). Buried several centimeters beneath the surface sediments, the oil changes very little via the evaporation, dissolution, oxidation, or emulsification mechanisms. Biodegradation, the remaining process, is slowed by lack of nutrients and dissolved oxygen, and the time for degradation lengthens from days and months to years (Kolpack, 1971; Blumer and Sass, 1972a, 1972b). Large quantities of oil that inundate a beach or that are sunk in a specific area, for example, by adding chalk, can cause erosion and thereby enlarge the affected area by carrying oil farther form the original site (Blumer, 1969, 1971; Blumer and Sass, 1972a, 1972b; Kolpack, 1971). Much work remains to be done to elucidate the effects of oil in sediments, especially in deep sea sediments (NAS, 1975).

In summation, petroleum substances discharged into the ocean are subject to certain physical, chemical, and biological processes that modify the original composition. Volatile, soluble, and easily biodegraded components disappear in several days. The remaining fractions are emulsified and broken into small patches and tar balls and either dispersed in the sea or incorporated into the sediments.

Crude oils and heavier fuel oils will leave residues that may in time reach the shore while lighter fuel oils and distillates will not. An oil spill that occurs on the open ocean will cause much less damage than one that occurs near shore since the more immediately toxic components will evaporate or dissolve to form very dilute solutions. If a spill occurs near shore, the oil that inundates the beaches and marshlands will not have had time to weather, and a greater amount of both immediate and long-term damage will result. The prevailing wind, waves, currents (Section II.C.) and distance from shore determine whether or not the spilled oil will reach shore and what its composition on arrival will be.

The only crude oil yet discovered in the Atlantic Region is that found off Sable Island, Nova Scotia (Section II.A.2.). The available data listed below[1] indicates a very light and medium crude oil.

| Interval | Oil Gravity | Sulfur | Viscosity |
|---|---|---|---|
| | API | | SUS 60°F |
| A | 35-41 | 0.02-0.032 | 33-36 |
| B | 50-58 | 0.005-0.007 | 29-30 |

However, no assumptions pertaining to the composition of crude oil in the proposed Mid-Atlantic sale area can be made.

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[1]Copy of letter from Mobil Oil Canada, Ltd., to Exxon Company USA, Appendix 5.

## 4. Oil Spill Trajectories in the Mid-Atlantic Region

The introduction of offshore petroleum activities in the Mid-Atlantic as a result of this proposed sale presents the possibility of an oil spill occurring at some time. At present, the exact mechanisms which combine to move an oil slick across the sea are not fully understood as demonstrated in several of the papers written on the subject (Fay, 1969; Alofs and Reisbig, 1972; Hoult, 1972; Reisbig, 1973; Reisbig et al., 1973; Stewart, 1973; and others).

In order to assess the possibility of oil spills from offshore locations in the Mid-Atlantic OCS reaching shore sites, a variety of computer simulations have been conducted. It should be remembered that two separate and distinct probabilities are involved in this type of analysis. The first is the probability of a spill occurring (which has been discussed in Section III.A.2.), and the second is the probability of a spill impacting the shore.

### MIT Model

One of the first trajectory studies for the Mid-Atlantic OCS area was conducted by Stewart, Devanney, and Briggs (1974b) at the request of the Council on Environmental Quality.

In developing their model, they decided to use the observation of Smith (1968) that oil on the surface tends to move at a velocity approximately equal to the vectorial sum of three percent of the surface wind velocity plus the current velocity.[1] The works of Wu (1968), Van Dorn (1953) and Hoult (1972) seem, in general, to support this figure of 3 percent. In using Smith's observation, Stewart et al. (1974b) modified it somewhat so that the current velocity was divided into two components: the tidal current and the residual current. The formula thus takes on the following form:

$$\vec{U}_{oil} = 0.03\,\vec{U}_{wind} + \vec{U}_{tidal} + \vec{U}_{residual}$$

The residual current is defined by the authors as meaning all currents whose period of fluctuation is large with respect to the life of the spill. Using this definition, the model ignores medium scale phenomena, such as Gulf Stream eddies and shelf-waves. This introduces some degree of error, especially since the work of Morgan and Compton (1974) suggests the existence of anti-cyclonic eddies along the outer edge (180m) of the Mid-Atlantic

[1]Although a variety of values have been used, uncertainty of the process means that the 3 percent figure falls within the average of valid multipliers. R. Stewart, Massachusetts Institute of Technology, personal communication, October, 1975.

Continental Shelf. Another reason for error is the lack of sufficient wind and current data for the Atlantic OCS. The authors were forced to use the only information available: drift bottles and card data, current charts, the geostrophy of the region, and plain old "oceanographic intuition". It was also assumed that the tidal motions could be ignored. This assumption will generate minor errors as long as the spill trajectory covers a sizeable number of tidal cycles, in which case the net transport due to tidal action will be quite small within the Mid-Atlantic region.

Wind movements were incorporated into the model with a number of assumptions: that the wind changes direction every three hours, that the wind blows from only eight directions, and that the directional shift only depends on the wind's present direction. Wind changes can occur more frequently than every three hours, and smaller-scale fluctuations may be missed due to the use of three hourly intervals. Furthermore, the wind does not blow from only eight directions plus calm but rather can come from any point of the compass. The randomizing process which is used to pattern wind movements has not been shown to accurately pattern true wind histories, although Stewart (1973) determined that the above assumptions account for only a 10 percent error of net spill dispersion.

Finally, as was the case with the currents, there is a lack of reliable data available. The authors of the model were therefore forced to obtain most of their wind data from shoreside weather stations. This greatly limits the wind model since frequently onshore wind data differ considerably from offshore wind data.

In determining oil spill trajectories for offshore regions, the problem regarding the uncertainty surrounding the specification of the ambient current components is encountered. The best available data was used, however, it is recognized to be very sparse and based on drift bottles studies which are few and have sometimes only resulted in a portion of the drift bottles being recovered. It was further assumed that the nonwind-related motions, of which these currents are composed, are weak compared to the wind-induced motions.

In order to test the validity of the trajectory model, it was decided to conduct tests using ballasted drift bottles launched in the areas of the hypothetical drill sites. For the purposes of characterizing the tests, the following parameters were used: percentage recovered, recovery region, and minimum and average times to recovery. Due to various probability tests, it was decided that the drift bottles do not act

independently but rather that they travel in a group. This statement implies, therefore, that the surface boundary layer is characterized by large scale, random fluctuations.

Figure III-5 shows the grid representation of the Mid-Atlantic region and the current traverse along the various hypothetical drill sites which were used in determining the impact sensitivities to the launch point position. It also depicts the ambient current pattern used in the model and the 0.5 knot Gulf Stream which is positioned on the southern boundary. The Gulf Stream's position was provided by the Virginia Institute of Marine Science (VIMS) (Welch, 1974), while the ambient current pattern came from Webster (1969) for the region south of Nantucket Shoals and from Baylor (by personal communication) for the region south of Long Island. The southward flow off the New Jersey coast, on the other hand, was deduced from dynamic height contours provided by VIMS and finally the region of calm (no current) was introduced as an approximation.

Although Figure III-5 depicts nine hypothetical drill sites,[1] for the purposes of this proposed lease sale, only EDS 6 (39°15'N, 73°W) (69 miles from the nearest shore), and EDS 7 (38°38'N, 73°30'W) (78 miles from the nearest shore) are of any major importance

[1]Estimated Drilling Site (EDS).

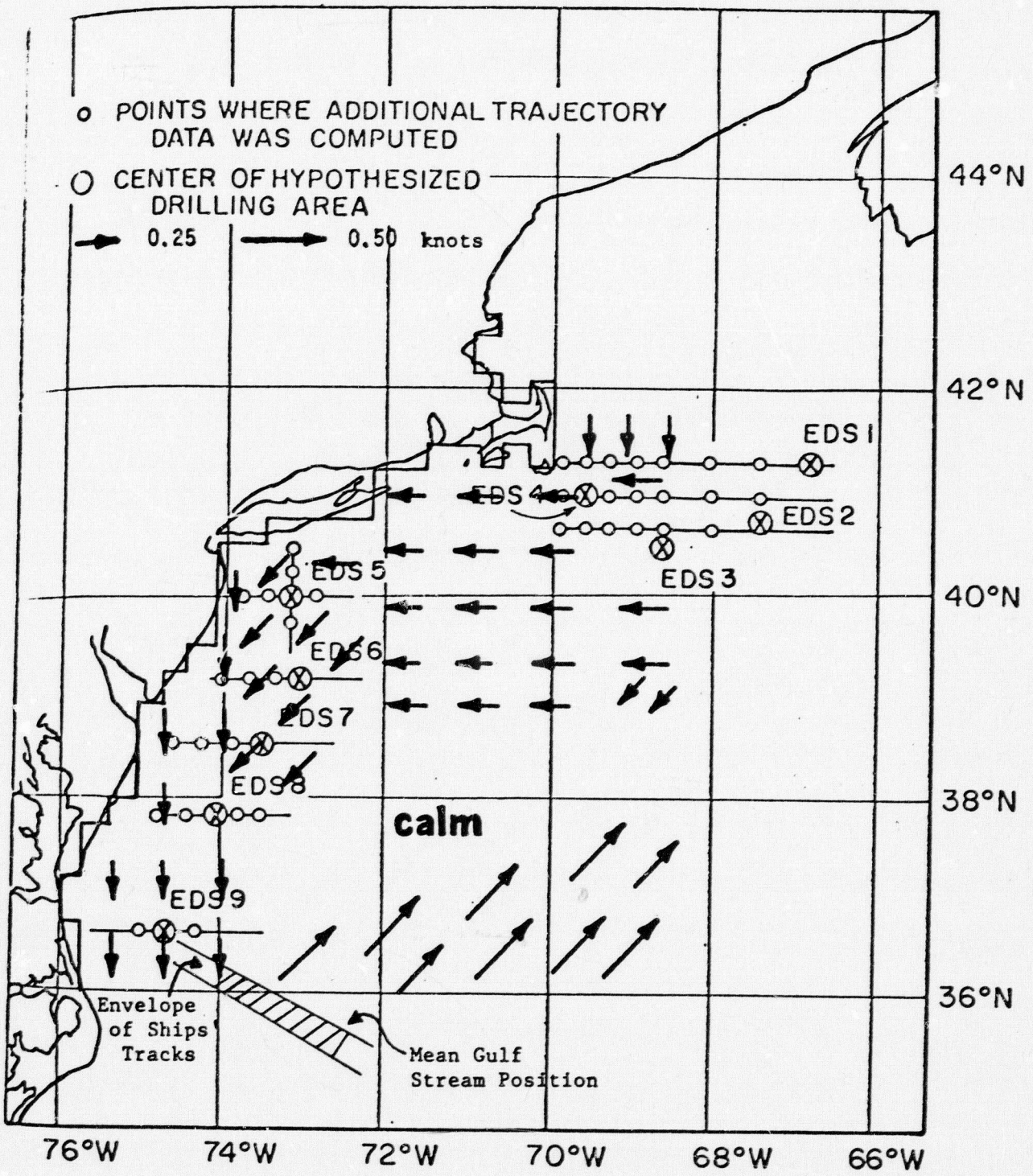
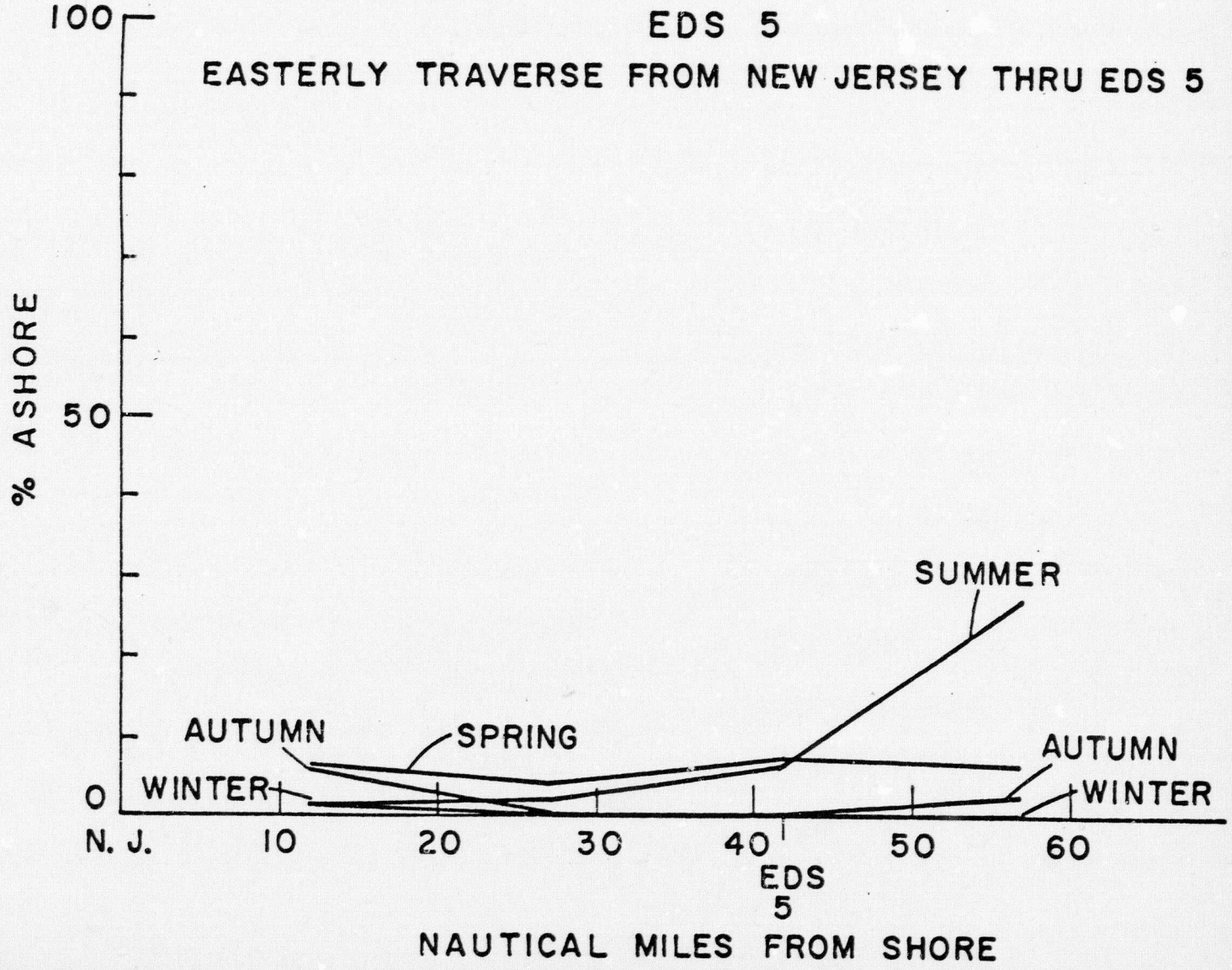



Figure III-5. Hypothetical Drill Sites, Hypothesized Current Pattern and Observed Gulf Stream Position
(Adapted from Stewart et al., 1974)

with EDS 5 (40°N, 73°10'W) and EDS 8 (37°50'N, 74°W) being of minor importance. Upon running their model, Stewart et al. (1973) were able to compile charts (Figures III-6 to III-9) which graphically display, on a seasonal basis, the probability of an oil spill released along the east-west traverses impacting the shore. It should be mentioned that even though this model predicts the probability of a spill impacting shore, it does not nor does it try to predict area of impact. After obtaining the model predictions, the authors compared them to the drift bottle data and found poor correlation in one season for EDS 6, 7, and 8. They then hypothesized that this poor correlation might imply that during at least one season, there is some sort of change to the ambient current system which is not accounted for in their model, since one current pattern was maintained for all seasons. Such a change in current has been discussed by Bumpus (1969, 1973a) to some extent. Using drift bottle data, he has observed that, between the months of May to October, it is possible for the current pattern along the Mid-Atlantic to change from a southwesterly flow to a northeasterly. It is quite possible, however, that Bumpus' interpretation of the drift bottle data is not attributable to current reversals but rather to any one of a number of factors.

In analyzing their results, the authors come to the conclusion that for EDS 6, 7, and 8, spring represents the season of greatest risk. During spring a spill, emanating from the center of either

Figure III-6. Dependence of the Probability of a Spill Impacting Shore on the Distance from Shore of the Spill Launch Site (Adapted from Stewart et al. 1974b)



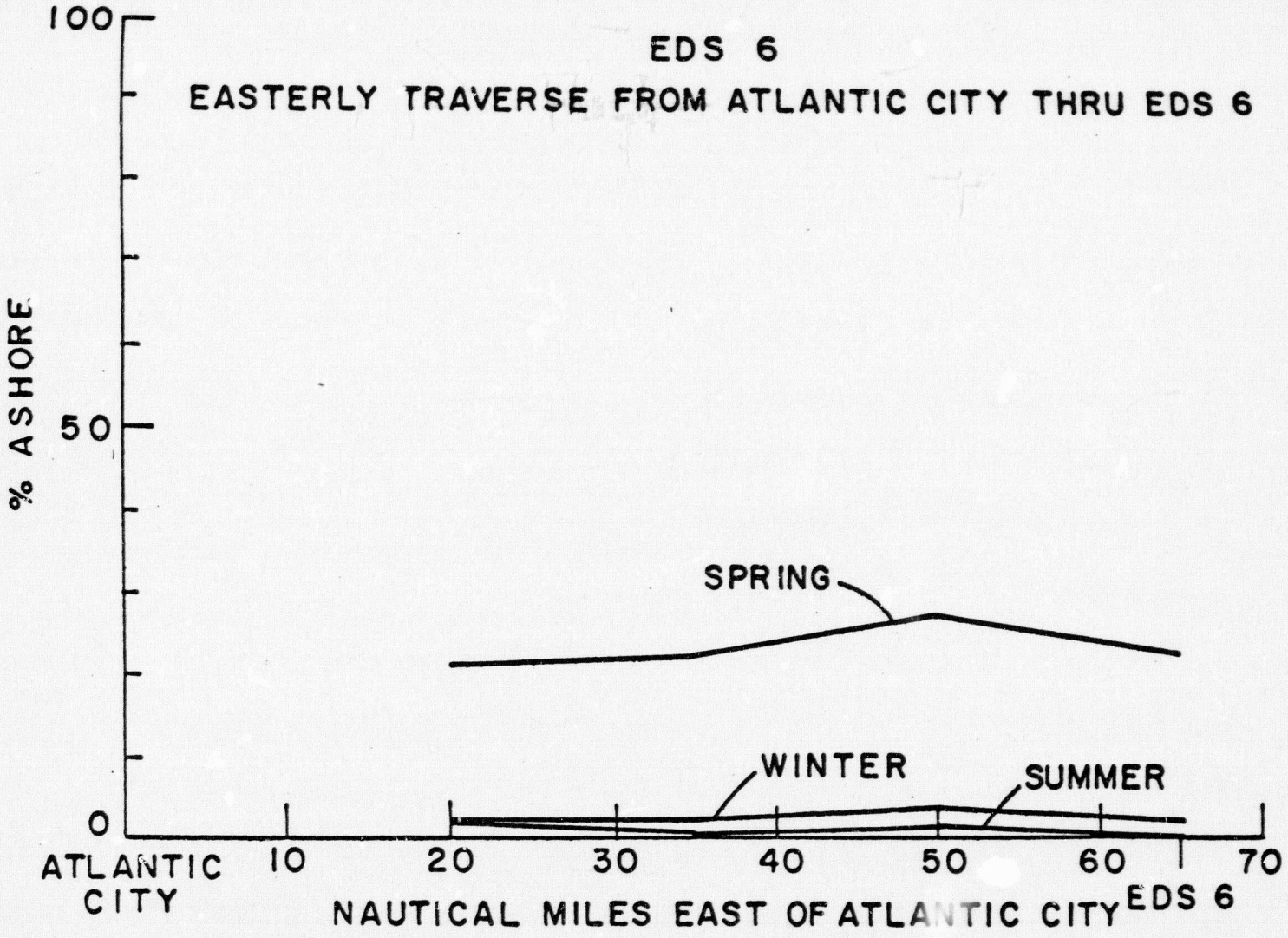



Figure III-7. Dependence of the Probability of a Spill Impacting Shore on the Distance from Shore of the Spill Launch Site (Autumn is not depicted due to the low probability during this season)
(Adapted from Stewart et al., 1974b)

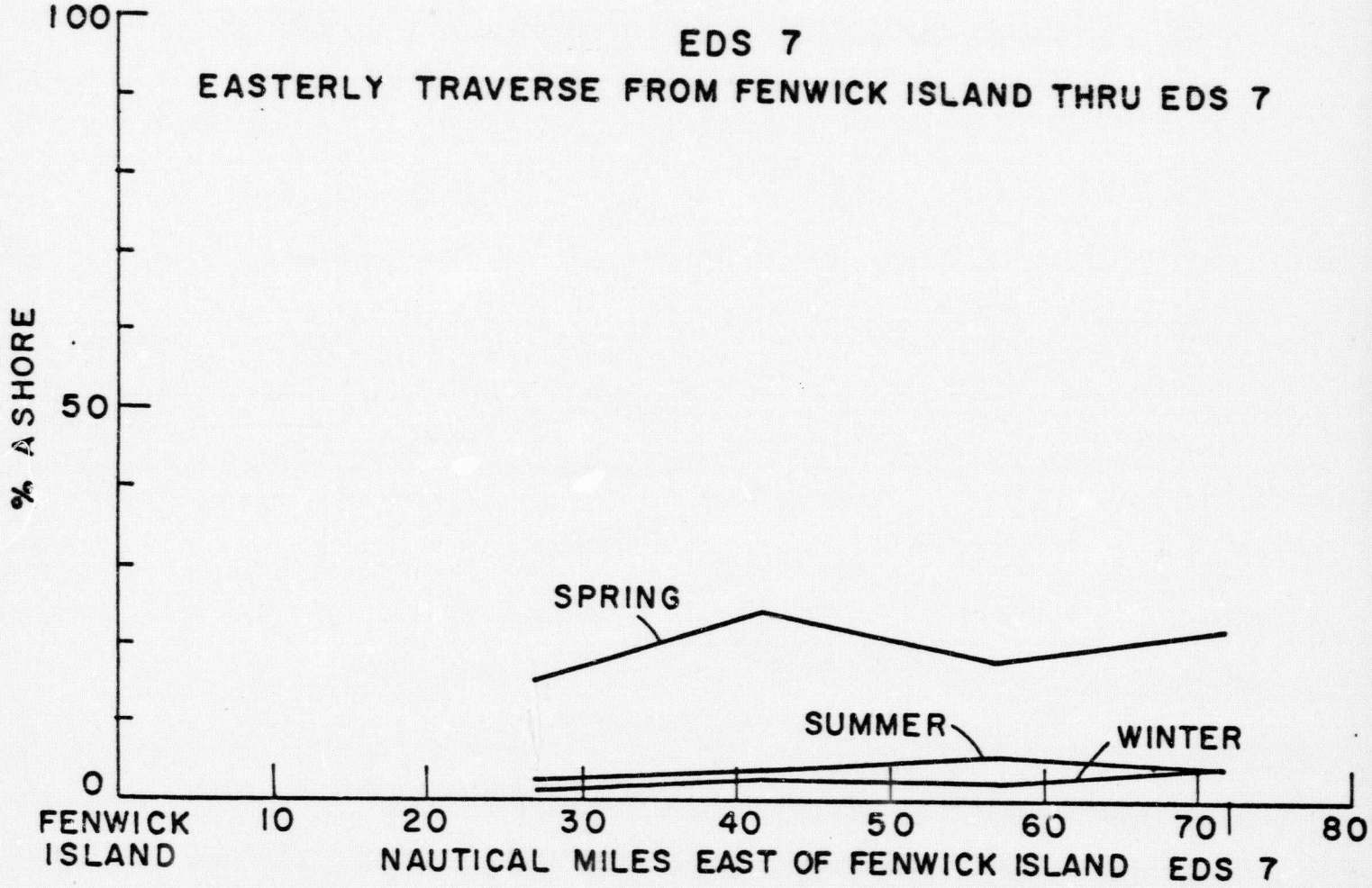



Figure III- 8. Dependence of the Probability of a Spill Impacting Shore on the Distance from Shore of the Spill Launch Site (Autumn is not depicted due to the low probability during this season) (Adapted from Stewart et al., 1974b)

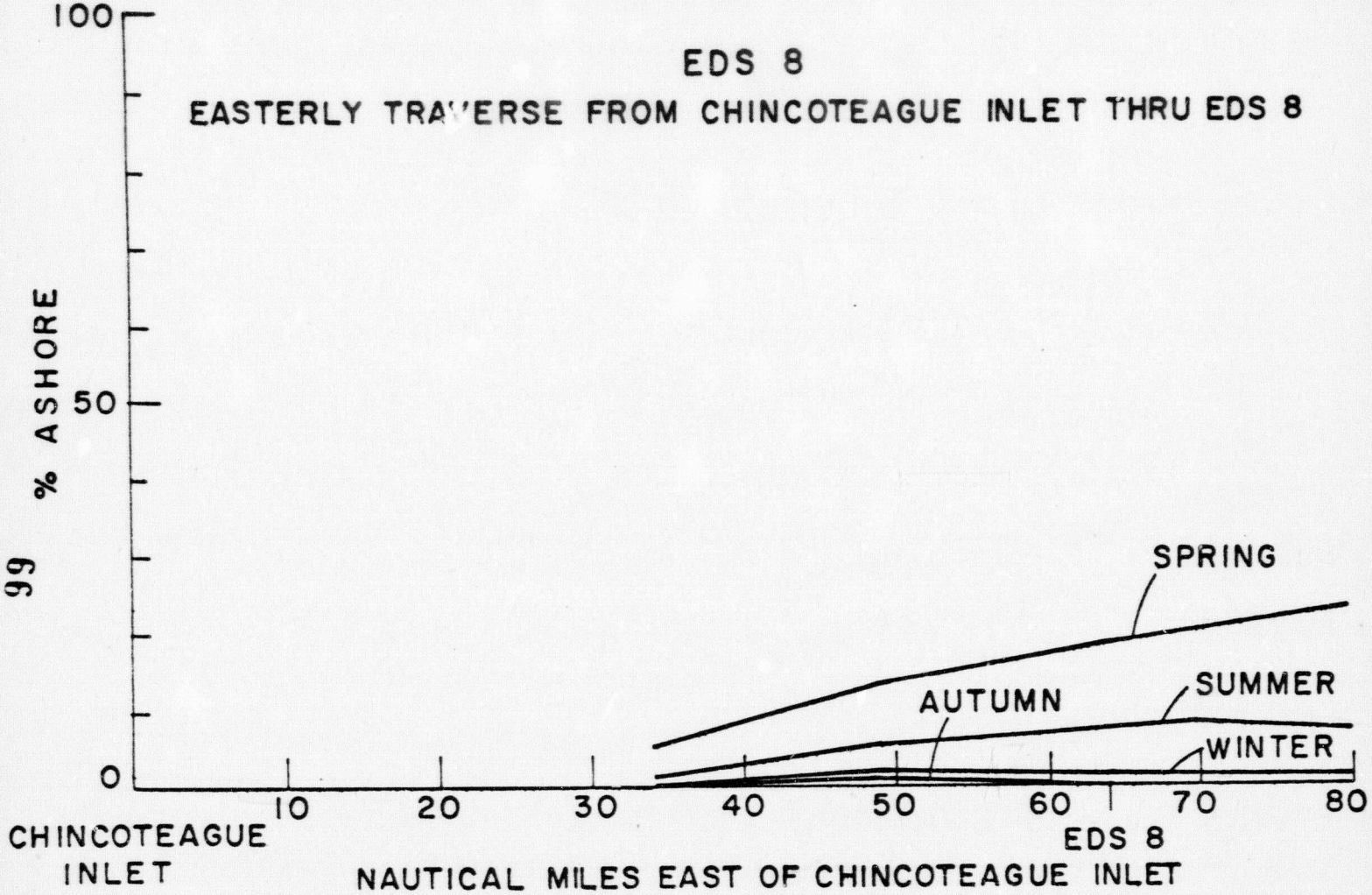



Figure III-9. Dependence of the Probability of a Spill Impacting Shore on the Distance from Shore of the Spill Launch Site
(Adapted from Stewart et al., 1974b)

EDS 6, 7, or 8, has approximately a 25 percent chance of impacting the shore; for the other three seasons the percentages decrease to approximately 8 percent or less. A spill emanating from the center of EDS 5, on the other hand, presents the greatest possibili of impact (approximately 6 to 9 percent) during spring and summer. For autumn and winter, however, the percentages decrease to almost zero percent. They also reemphasize the fact that the results must be treated with caution due to the hypothetical nature of the ambient current.

Finally, besides computing the probability of impact, the authors also computed the average and minimum times to shore (Table III-19). They found that for EDS 6,7, and 8, if a spill was to impact the shore, it would take an average of 83.8 days before impact and the absolute minimum time would be 46 days. EDS 5, on the other hand, had an average time of 1? to 20 days and a minimum time of 6 days.

Because these times to shore are so long, the authors felt that, except for the very largest of spills, the oil will be dispersed over a large area and the larger patches will have been replaced by tar balls and/or other remnants. This being the case, these spills will have a reduced impact upon beaching (Section III.A.3.).

Applied MIT Models

Devanney and Stewart (1974a) applied the MIT model to oil spills released north of 40°N latitude and found decreasing chances if impact on Long Island as the release point was moved

Table III- 19 Minimum and Average Times to Shore for EDS 5, 6, 7, and 8

| EDS | Winter | | Spring | | Summer | | Autumn | |
|---|---|---|---|---|---|---|---|---|
| | Minimum | Average | Minimum | Average | Minimum | Average | Minimum | Average |
| 5 | * | * | 6 | 20 | 6 | 12 | * | * |
| 6 | 46 | 76 | 61 | 90 | 82 | 88 | * | * |
| 7 | 46 | 87 | 59 | 86 | 61 | 82 | * | * |
| 8 | 55 | 87 | 54 | 85 | 47 | 73 | * | * |

*The possibilities of a spill impacting shore during these seasons were so negligible that the minimum and average times to shore were not computed.

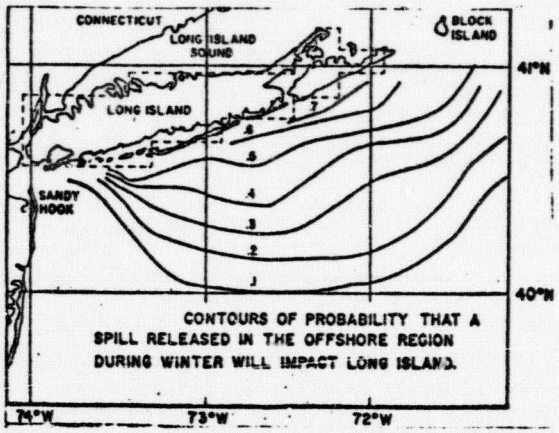
further south. Since the closest tract of this Sale No. 40 proposal to 40°N is nearly 30 miles farther south, the potential concern to Long Island is significantly reduced. Average times to shore as indicated in this study were approximately 20 days from release points at 40°N. Figures III-10a and III-10b show probability contours for summer and winter. A second study by Stewart and Devanney (1974) focused primarily on spills emanating from Nantucket Shoals and is thus out of our area of interst. Problems with both of these reports are as stated previously in connection with the CEQ study, although Stewart and Devanney (1974) do include Markov processed offshore wind data rather than onshore data.

Coast Guard Models

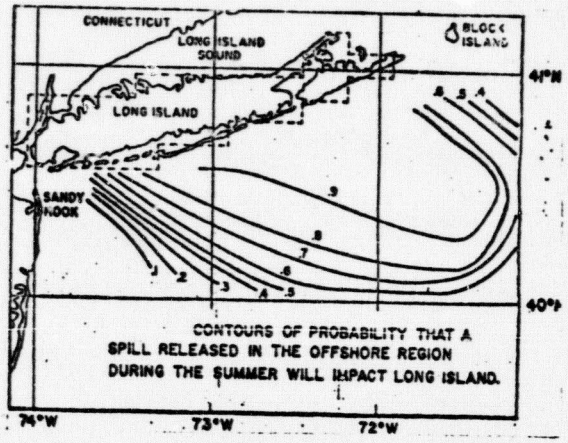
As part of the Office of Technology Assessment's (OTA) project related to future energy facilities offshore of New Jersey and Delaware, the U.S. Coast Guard has prepared two separate computer

Figures III-10a-10d

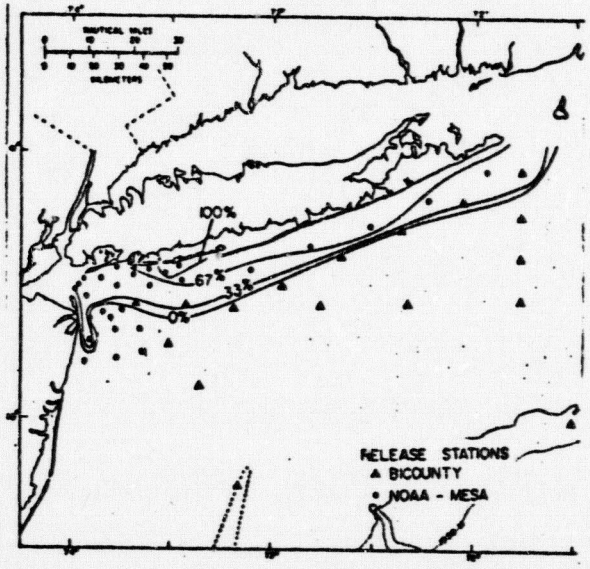
10a (Winter)



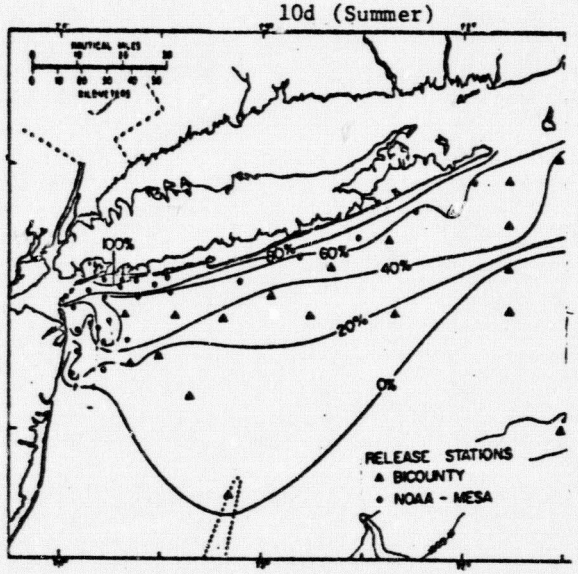

10b (Summer)




10c (Winter)




10d (Summer)




Figures III-10a and 10b. Probabilities that oil spills will strand on Long Island (From Devanney et al. 1974)
Figures III-10c and 10d. Probabilities that oil spills will strand on Long Island within 60 days of spill release. Release stations are for drift cards; "bicounty" releases were performed specifically for the study, NOAA-MESA releases coincided in timing (From Hardy et al. 1975)

simulations of oil spill trajectories in the Mid-Atlantic. The first of these (Lissauer and Bacon, 1975) used monthly averages of offshore wind data (ship observations) and monthly averages of water current data. Applying a 3.5 percent wind drift factor for the vector summation, a hypothetical spill from each of six sites is projected towards shore, thus giving an arrival time and location (only one of these sites (#2) is actually located among the tentatively selected tracts of this proposal). Very short arrival times are given for all six spill launch sites (four to nine days for site #2) with most spills impacting the shoreline from Sea Girt, New Jersey, to Ocean City, Maryland. The most significant problem with this model is the basic assumption that the wind blows constantly at one speed and from one direction for the entire time that it takes for the hypothetical spill to arrive ashore. Because the model was prepared in order to answer questions about where a spill might come ashore and not if if would come ashore, only those wind directions which could carry a spill towards shore are presented (average wind directions for the Mid-Atlantic area are actually in opposite directions--and more frequently so--than the directions chosen for this Coast Guard model).

The second Coast Guard study (Miller, Bacon, and Lissauer, 1975) examined whether or not a spill could come ashore as the result of a winter storm or stagnant high pressure system in summer.

The hydrodynamical-numerical model used to simulate surface water movements incorporated past oceanographic knowledge along with data collected specifically for forming boundary conditions. It has been partially verified by comparing its output to tidal data for specific areas. Wind data input was developed by examining the historical movement of barometric pressure centers across the Mid-Atlantic; selecting and idealizing a summer and winter event; predicting winds at individual locations using Godske's (1957) equation; and applying the input to a spill trajectory and spreading equation.

Using data from one actual winter storm in March of 1971, and a stagnant summer high pressure area which would produce S - SE winds at 15 knots, a hypothetical oil spill from each of four sites is tracked for both direction and dispersion. Two of these sites are denoted as possible deepwater ports and two as possible drilling sites. Only drilling site #2 ($39^{o}30'N$, $72^{o}55'W$) is among the tentatively selected tracts. In the case of the winter storm, the hypothetical oil spills from all four sites started to move towards shore, but as the storm tract passed through the area a wind shift drove the spills back out to sea. The authors state that if the storm had stalled and become stationary south of the spill sites for several days, the chance of oil impacting shore from any of the sites would be high. Using a summer high pressure system, they found that a spill from the hypothetical drilling

sites would be moving shoreward, but after 25 hours was 40 to 50 miles offshore. Miller et al. (1975) felt that the probability of a spill reaching shore is not as great as for the hypothetical deepwater port spills (30-35 miles from shore), but that they could begin to come ashore in 4 to 5 days if the high pressure system remained stationary for that length of time.[1]

The second Coast Guard model includes the best weather and water current data available, but there are still some deficiencies in the model for our purposes. The dispersion routine which was incorporated in the model was unverified and admittedly needed improvements. A coastal storm which the authors suggest may bring a spill onshore may also break up and weather the spill at sea. Neither the extreme summer nor winter conditions which the authors feel could bring a spill ashore from the hypothetical drilling sites were run, nor were they run for the length of time necessary to bring the spill "ashore."

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[1] It should be kept in mind that summer conditions would be more conducive for oil spill cleanup operations - Section II.C. (Wave Conditions), III.C.7., and IV.C.

Hardy Model

Hardy et al. (1975) performed extensive drift card releases south and east of Long Island during 1974. An analysis of card returns, existing wind conditions, and water currents in the New York Bight were used to arrive at probabilities that an oil spill might impact Long Island (the drift cards were assumed to travel like an oil slick). Although somewhat different in approach, the main conclusions were similar in that the proposed tracts are too far south for spills there to affect Long Island:

> During the winter months the probability of a spill stranding from more than ten miles offshore is zero percent... During the summer months the probability of stranding of a spill within 30 miles seaward of Long Island is greater than zero percent within sixty days...it is unlikely that oil spills from the Baltimore Canyon (trough) would strand upon Long Island. (Hardy et al., 1975)

Figures III-10c and 10d show the estimated probabilities of spills impacting Long Island. In this study, no effort was made by Hardy et al. to analyze potential impacts other than on Long Island and no attempt was made to examine spill dispersion and weathering. The use of drift cards to simulate oil slick movement is still uncertain over the 10 day or greater time frames discussed here, though the basic conclusions are reasonable, given what is known about offshore winds and currents.

## Brookhaven National Laboratory Model

The U.S. Energy Research and Development Administration's Brookhaven National Laboratory developed another model (Written Testimony, DES for Proposed OCS Lease Sale No. 40) with conclusions quite similar to those of Hardy et al. (1975). Brookhaven Laboratory's study used a computer simulation of oil spills like that of the previously mentioned work of MIT researchers; however, the movement of currents and winds incorporated the most recently available data from the NOAA-MESA Project. Probabilities of oil spill impact on southern Long Island were regarded as quite low when release points were more than 15 miles from that shore.

A conclusion that can be reached from the last four trajectory models mentioned is that spills from the proposed Baltimore Canyon Trough leasing tracts are unlikely to impact Long Island. By examination of Figures III-10a through III-10d it also seems unlikely that spills from oil pipelines to New Jersey would ever impact Long Island unless the pipelines were in the vicinity of northern Monmouth County. Tankers, if they have to be used, bringing oil into Raritan Bay would provide a greater chance of spills reaching southern Long Island.

Although the second Coast Guard model (Miller et al., 1975) and the Brookhaven National Laboratory model represent more advanced trajectory studies than that of Stewart et al. (1974b), information provided in them is inadequate to fully analyze both minimum and average times to shore from the present grouping of tracts.

## OCS Oil Spill Trajectory Model

A recently developed oil spill risk analysis model was used by the Department of the Interior to better determine the relative hazards associated with OCS oil and gas development in different portions of this proposed Mid-Atlantic Lease Sale No. 40 area.

Utilizing available environmental data specific to the Mid-Atlantic region, the model provides a means of first analyzing the probabilities of OCS-related oil spills occurring, and second to evaluate possible drilling site locations within the proposed sale area in relationship to potential impacts on the environment of the Mid-Atlantic coastal region in case of an OCS oil spill. The model also determines the average time that it would take for a hypothetical spill to reach an environmentally sensitive area. This analysis may facilitate determination of significant tradeoffs for possible selection of tracts that may be offered for lease should this sale be held. The details of the model description and the methodology utilized will be discussed in a forthcoming USGS publication.[1]

Statistical distributions for estimating the frequency of oil spills was taken from the report of Devanney and Stewart (Analysis of Oil Spill Statistics, 1974) that was submitted to the Council on Environmental Quality discussed earlier in this section.

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[1]Richard A. Smith, James R. Slack, and Robert K. Davis, "Oil Spill Risk Analysis for OCS Lease Sales," U.S. Geological Survey, 1976, in preparation.

In attempting to keep the risk analysis as simple as possible, spreading and weathering effects of oil spills were not included. Spreading and weathering are primarily significant in trying to determine the length of time that oil can be transported in the water without breaking up, disappearing, or sinking. In addition to this limitation of the analysis, other limitations are: a) does not consider the actual effects on resources; b) does not consider the relative importance of the different resource values, and c) does not consider the reduction in accident rate effected by recent and future technological developments.

On the basis of the USGS estimated undiscovered recoverable oil resources for this proposal (1.4 billion barrels), and the anticipated level of development of the proposed 876,750-acre lease sale area, i.e., number of platforms, pipelines (Sections I.D. and III.A.1.), it was estimated that with 70 percent likelihood a total of from 2 to 7 major spills could be expected to occur during the production life of the area (25 years), if all proposed tracts were to be leased and developed. For purposes of the analysis a major spill was defined as the release of more than 1,000 barrels of oil. Spill frequency estimates were similarly made for spills greater than 50 barrels of oil.

Representative spill sites were selected for analysis from within four basic subdivisions comprising the proposed sale area (Figure III-11). Subdivision I consists of the northwest portion (48 tracts); II the northeast portion (27 tracts); III the mid-portion (41 tracts); and IV the separate lower portion (38 tracts) of the proposed sale area. Seven representative spill site locations were

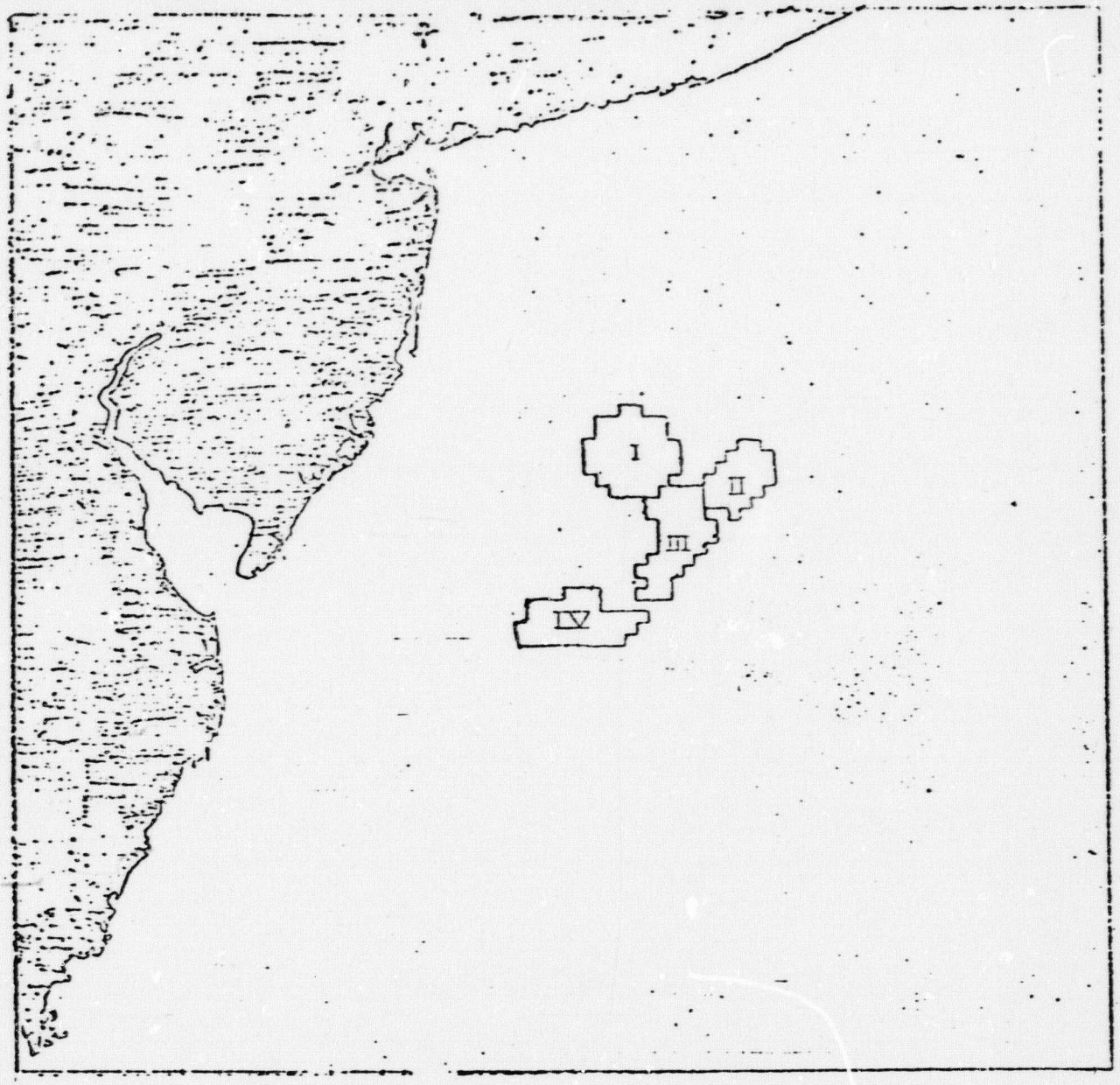



Figure II- 11. Subdivisions of the Proposed Mid-Atlantic OCS Lease Sale No. 40 Tentative Tracts.

selected for analysis within these four subdivisions, corresponding to possible oil fields.

Using the best available wind and current data, an oil spill trajectory model was constructed and used to analyze movements of hypothetical oil slicks on a digital map of the area. The area that might be affected was defined as that portion of the Mid-Atlantic Bight bounded by Long Island on the north (approximately 41°N latitude), 71°W longitude on the east, 37°N latitude on the south (tip of Cape Charles, Virginia), and the Atlantic Coast shoreline on the west.

This analysis utilized wind data available for the period from January 1961 to December 1967 from the Barnegat Light Ship located approximately nine miles east of Barnegat Light State Park, New Jersey (39.7°N and 73.7°W). Short-term patterns in wind variability (6-hour intervals) were simulated in a transition matrix and utilized in a first-order Markov process (a Monte Carlo technique). Wind transition probability matrices as well as surface current velocity fields were established separately for four seasons. Current velocity fields were derived from the Dean F. Bumpus current data for the Mid-Atlantic area as shown on Visual #2. The overall Mid-Atlantic Bight area was divided into a series of smaller areas using the full value of predicted currents. The representative current direction and velocity were noted and then varied as a function of season. A slight surface current (.02 k) moving out from the large bays within the Mid-

Atlantic area was simulated to account for the effect of freshwater net outflow. Since the overall potential time of transport of a spill in this area is on the order of many days, tidal currents were not considered. (The daily diurnal cycle of tidal currents will average out during the several days that will take place during the time required for transport of any oil spilled.)

The resource characteristics of the Mid-Atlantic onshore and offshore environment were categorized into ten groups as discussed below in order to evaluate the potential impacts of a spill if it should reach a critical resource. These groups were digited into the coordinate system used in the spill trajectory model simulations. Probability distributions were then developed giving the likelihood that spills occurring at various locations in the proposed lease area would impact the resources in question. The resource category groups were made seasonally specific so that the results of the impact analysis would reflect significant seasonal correlations between wind and current patterns and the risks most likely inherent to the resource groups.

By combining oil spill frequency estimates with the trajectory analysis, it was possible to array the relative oil spill hazards posed by the oil and gas development of tracts that are proposed to be leased to the resource groups at different locations.

The ten resource groups evaluated in relation to the potential effects of an oil spill were as follows:

Group 1. Endangered Birds. The known and suspected habitats of the

American peregrine falcon, Southern bald eagle, and osprey were identified along the shoreline (all seasons).

Group 2. Migratory Waterbirds. Wildlife management areas, refuges, and portions of Cape May County, New Jersey were identified as having significant concentrations of migratory waterbirds during the winter, spring and autumn seasons.

Group 3. Shellfisheries. Areas along the shore were identified that contain surf clams, bay scallops, northern hard clams, and oysters. Both commercial and sports harvesting areas for these species were included (all seasons).

Group 4. Coastal Finfish. A strip along the entire length of shore approximately 25 miles wide was identified as offshore critical habitat during the summer and autumn seasons when an oil spill would be potentially harmful to the egg and ichthyoplanktonic stages of the scup, porgy, and menhaden.

Group 5. Estuarine Finfish. Key estuarine areas were identified as having significant habitat for weakfish, sea trout, whiting, and striped bass that could be impacted by an oil spill during the spring, summer, and autumn seasons.

Group 6. Wetlands. All marsh areas were identified (all seasons).

Group 7. Wildlife Refuges and Management Areas. All National Wildlife Refuges, and wildlife management areas, wildlife areas, and natural areas were identified (all seasons).

Group 8. Beaches with High-Intensity Use. Gateway National Recreation Area, including adjacent State and municipal beaches;

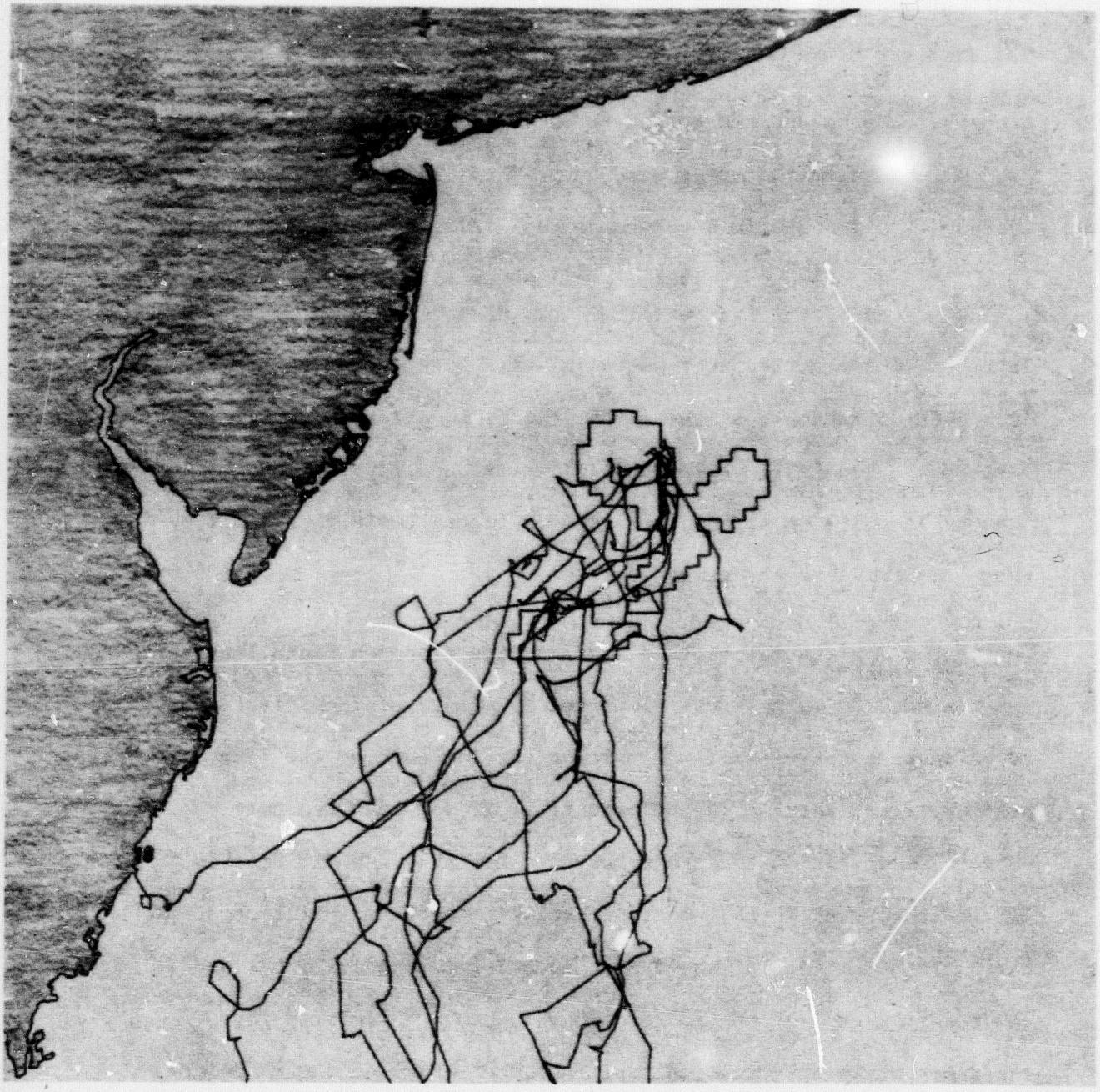
Atlantic City, New Jersey's Boardwalk area; Cape May County, New Jersey, beaches; Rehoboth Beach, Delaware, area beaches; and Ocean City, Maryland, area beaches.

Group 9. Parks and Recreation Areas. All State Parks and National Recreation Areas were identified (all seasons).

Group 10. Mid-Atlantic Bight Dumpsites. All EPA-permitted dumpsites as shown on Visual #1 (all seasons).

It was also recognized that potential harm might occur to the egg and ichthyoplanktonic stages of the bluefish, Atlantic mackeral, butterfish, red hake, yellow-tail flounder, and fluke flounder, however, a spill in any of the proposed tracts could impact all of these fisheries at any time.

During the application of this model to the proposed Mid-Atlantic lease area, 100 spills were simulated from each of the selected seven representative spill site locations for each of the four seasons, for a total of 2,800 potential oil spills. Randomly selected examples of the trajectory results are shown in Figures III-12 through III- 15, where several hypothetical spills originating from a potential spill site location in subdivision I are shown during each of the four seasons. The days required for transport of the hypothetical spill before impact on the shore are shown beside each spill that actually does impact the shoreline.



WINTER

Figure III-12. Trajectories of Spills Released From One Representative Spill Site Location in Mid-Atlantic Proposed OCS Lease Sale No. 40 Area.

SPRING

Figure III-13. Trajectories of Spills Released From One Representative Spill Site Location in Mid-Atlantic Proposed OCS Lease Sale No. 40 Area

SUMMER

Figure III-14. Trajectories of Spills Released From One Representative Spill Site Location in Mid-Atlantic Proposed OCS Lease Sale No. 40 Area

AUTUMN

Figure III-15. Trajectories of Spills Released From One Representative Spill Site Location in Mid-Atlantic Proposed OCS Lease Sale No. 40 Area

The probability that a spill, if one occurs, will impact shore is 10 percent for the entire proposed area, as shown in Table III- 20 below. The corresponding probabilities for each of the four subdivisions are also indicated. It should be noted that the range in the probabilities from each of the different subdivisions is relatively small.

Table III-20. Probability That A Spill, If One Occurs, Will Impact Ashore

| Probability Ashore | P(%) |
|---|---|
| Subdivision I | 14 |
| Subdivision II | 9 |
| Subdivision III | 6 |
| Subdivision IV | 11 |
| Entire Proposed Area | 10 |

The probability that a spill, if one occurs, will impact any of the ten groups described previously is shown in Table III-21 below.

Table III-21. Probability That A Spill, If One Occurs, Will Impact Resource Groups of the Mid-Atlantic Area[1]

| Group | Probability (%) |
|---|---|
| 1. Endangered Birds | 1.5 |
| 2. Migratory Waterbirds | 4.0 |
| 3. Shellfisheries | 1.0 |
| 4. Coastal Finfish | 7.0 |
| 5. Estuarine Finfish | <1.0 |
| 6. Wetlands | 3.0 |
| 7. Wildlife Refuges and Management Areas | 6.0 |
| 8. Beaches With High-Intensity Use | 2.0 |
| 9. Parks and Recreation Areas | 5.0 |
| 10. Mid-Atlantic Bight Dumpsites | 12.0 |

[1]Including consideration of seasonal vulnerability.

Spill frequency estimates for spills of greater than 1,000 barrels of oil, based on distributions of Devanney and Stewart, are shown in Table III- 22. This table indicates the expected number of spills and the probability of at least one spill occurrence over the 25-year estimated production life of the area for the entire proposed lease sale area. The table gives spill frequency data for offshore platforms, pipelines, and tankers (if they have to be used), as well as for offshore production together with pipeline transport of production, and offshore production together with tanker transport, should tankers have to be used.

Table III-22. Spill Frequency Statistics by Potential Source of Spill Over 25-Year Life of Area (spills greater than 1000 barrels)

| | Expected Number of Spills | Probability of At Least One Spill Occurrence |
|---|---|---|
| Platforms | 2.3 | .90 |
| Pipelines | 2.5 | .92 |
| Tankers | 3.3 | .96 |
| Platforms & Pipelines | 4.8 | .99 |
| Platforms & Tankers | 5.6 | .99 |

The expected number of oil spills over 50 barrels in size for the entire proposed lease area over the 25-year production life of the area from combined platform production and transport to shore via pipelines is 22.65. Thus, since 4.8 spills greater than 1,000 barrels in size are expected to occur, the number of spills between 50 and 1,000 barrels is expected to be 17.85 if oil is produced and transported to shore via pipelines.

Based on the spill frequency estimates for spills over 50 barrels in size, and considering the probability that spills that do occur will hit a resource group, Table III-23 indicates the overall probability (over the 25-year production life of the area) of at least one hit on any of the ten resource groups. For comparison, the probabilities for spills greater than 1,000 barrels hitting the resource groups from anywhere in the entire proposed lease area are also shown. There is a 90 percent probability that at least one spill over 50 barrels in size from any place in the entire proposed lease area will reach shore at some point along the Mid-Atlantic coastline. Similarly, there is only a 39 percent probability that a spill over 1,000 barrels in size will reach shore. However, it is important to note that these estimates do not consider the significance of weathering in reducing the impacts of spills that would reach shore and impact these resources.

Table III-23. Probabilities of Spills Occurring and Impacting the Resource Groups of the Mid-Atlantic Area,[1] Over 25-Year Production Life of the Area

| Subdivision | Probability (%) I | II | III | IV | Entire Proposed Area | Entire Proposed Area (spills greater than 1000 barrels) |
|---|---|---|---|---|---|---|
| Group | (spills over 50 barrels) | | | | | |
| 1. Endangered Birds | 22 | 5 | 4 | 3 | 31 | 8 |
| 2. Migratory Waterbirds | 31 | 11 | 11 | 29 | 61 | 18 |
| 3. Shellfisheries | 9 | 4 | 4 | 5 | 20 | 5 |
| 4. Coastal Finfish | 52 | 19 | 18 | 37 | 80 | 29 |
| 5. Estuarine Finfish | 1 | 1 | 2 | 2 | 4 | 1 |
| 6. Wetlands | 28 | 12 | 08 | 17 | 52 | 14 |
| 7. Wildlife Refuges & Management Areas | 45 | 17 | 18 | 39 | 77 | 27 |
| 8. Beaches With High-Intensity Use | 20 | 4 | 6 | 8 | 34 | 8 |
| 9. Parks and Recreation Areas | 41 | 11 | 12 | 32 | 69 | 23 |
| 10. Mid-Atlantic Bight Dumpsites | NA | NA | NA | NA | NA | 44 |
| PROBABILITY OF COMING ASHORE | 65 | 24 | 28 | 48 | 90 | 39 |

[1]Including consideration of seasonal vulnerability.

NA - Not Available

One important factor determining the significance of weathering processes in reducing oil spill impacts is the length of time required for spills to come ashore. Figure III-16 gives the distribution of days at sea for the hypothetical oil spill trajectories considered in this study. The worst case (minimum amount of time) indicated that it took 3 to 5 days for spills to reach shore (in autumn). This was true for only about 2 percent (seasonal average) of the spills which hit land. Of the spills that hit land, 37 percent were estimated to come ashore in fewer than 15 days.

In summary, it seems reasonable to conclude that although there is a 39 percent probability that at least one oil spill greater than 1,000 barrels will reach shore during the anticipated 25-year production life of this area, any effects on the nearshore or onshore environment would be due to the residual oil, and not the more toxic lighter fractions which would have already disappeared into the offshore environment. In the worst case it took four days for one of the 2,800 hypothetical spills to reach shore, however, the lighter, more toxic fractions of crude oil boil off (evaporate) during the first few hours of an oil spill leaving the heavier, less toxic hydrocarbons remaining, as discussed in Section III.A.3. previously.

It also seems reasonable to conclude that, due to the weathering process and the constant reduction in the amount of remaining

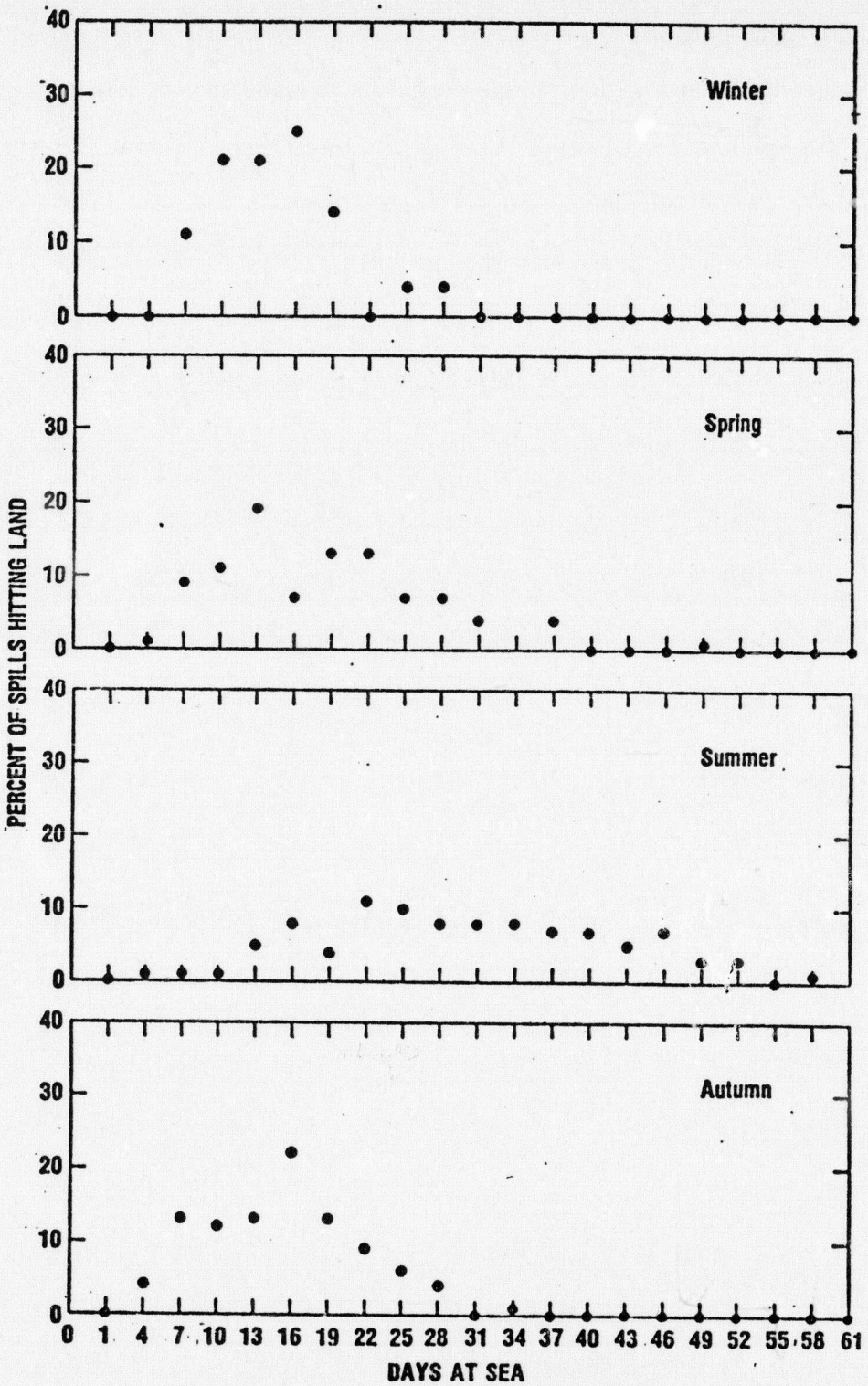



Figure III-16 . Percent of Spills Impacting Shore and Length of Time Before Hit, By Season for Proposed Mid-Atlantic OCS Lease Sale No. 40 Area.

residual hydrocarbons (Section III.A.3.) combined with the constantly improving effectiveness of oil spill containment and recovery equipment, the impacts associated with an oil spill reaching a shoreline would be relatively small. It is possible that impacts could occur in the form of well-weathered oil reaching shore in beach and wetlands areas. In addition, that well-weathered oil that enters the water column and reaches the ocean floor could impact various shellfish and finfish habitat areas.

## B. Impacts of Offshore Oil and Gas Operations on the Natural Environment

### 1. Water Quality

The following impacts on offshore water quality are based on the 90,000-740,000 barrels of oil per day at peak production (0.4-2.6 billion, total 25 year period) that are expected from this proposed sale and the other assumptions in Section III.A.1. Less signficant impacts would occur in cases of smaller production than this assumed peak and in the early and late stages of the assumed development timeframe.

The most severe degradation of the existing offshore water quality can be attributed to oil spills and the discharges of formation waters and drilling muds. Predictions of the quantities of oil spilled from blowouts, explosions, pipeline ruptures, and so on, indicate that several thousand barrels of oil could be accidentally introduced into the ocean. Section III.A.2. provides the volume statistics and an explanation for these predictions. The fate of spilled oil and its effects on the ocean flora and fauna are discussed in Section III. A.3. and III.B.2. The effects on water quality would include an increase in the percentage of dissolved hydrocarbons and trace metals in the surface and near surface waters. The deeper and bottom waters would also be contaminated by any oil carried down by particulate matter and incorporated into the sediments. These conditions would exist until the source has been exhausted or

shut off and the spill has dispersed (normally several days afterward). Actual effects are not quantifiable at present but would depend on volume and characteristics of oil spilled, the sea and weather conditions, and so on. The National Academy of Science (1975) has estimated that 0.38 million metric tons of oil enter the ocean via accidental spills each year; this figure includes tanker discharges. This is approximately six percent of the total oil introduced each year by various routes (Table III- 15, Section III.A.3.). Any small amounts of oil spilled on the rigs or platforms during normal operations would be removed with solvents which would then be collected via drains and gutters and processed through the waste treatment facilities.

Although no data are available at present on the concentration of the components, formation waters can be expected to contain hydrocarbons and dissolved mineral salts and some heavy metal traces, and would most often be devoid of oxygen (Section III.A.1.). Based on USGS estimates of 90,000 to 320,000 barrels of oil per day at peak production, we can expect a maximum of about 300,000 bbl/d of formation waters. In the high case (a large find), a maximum peak of 740,000 barrels (31 million gallons) per day of formation waters would be produced. EPA requires that these waters be treated to reduce their hydrocarbon content before their release to the ocean. The EPA standards promulgated for 1983 set this level at 30 ppm (Section III.A.1.c.).

Experience indicates that this standard is attainable.[1] During peak production, therefore, the maximum amount of oil introduced via formation waters would be 22 barrels (930 gallons) per day. This quantity, apportioned among the number of production platforms, would produce only incremental increases in the levels of hydrocarbons in the area waters. According to NAS (Table III-15, Section III.A.3.) the accidental loss of petroleum from offshore operations accounts for 1.3 percent of the total hydrocarbon input into the oceans. Of this, less than one-third is contributed by formation waters and spills of less than 50 barrels. This is much less than that contributed by rivers or natural seeps. Upon entering the ocean the hydrocarbons in formation waters, already in solution, are dispersed and diluted and are subject to the same physical and chemical processes discussed in Section III.A.3. Any cumulative effects over a long period of years are not determinable at present, but are being studied, such as those studies conducted in the BLM Environmental Studies Program discussed in Section I.D.2.

The mineral salts components of these formation waters are generally similar to those of seawater (Table III- 24), however, trace metals may also be present in the formation waters produced (Table III-5).

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[1]Samples collected by EPA from ten Gulf of Mexico wells showed effluent ranges from greater than 80 mg/l to 4 mg/l with median samples below 20 mg/l. Further discussion can be found in: EPA. 1975. Development Document For Interim Final Effluent Limitation Guidelines and New Source Performance Standards for the Offshore Segment of the Oil and Gas Extraction, Point Source Category. U.S. Environmental Protection Agency Report 440/1-75/055. Washington, D.C. 148p.

Table III-24 Comparison of Seawater and Oilfield Brine[1]

| | Seawater[2] (mg/l) | Oilfield Brine (mg/l) |
|---|---|---|
| $Na^{+1}$ | 10,600 | 12,000-150,000 |
| $K^{+1}$ | 400 | 30- 4,000 |
| $Ca^{+2}$ | 400 | 1,000-120,000 |
| $Mg^{+2}$ | 1,300 | 500- 25,000 |
| $Cl^{-1}$ | 19,000 | 20,000-250,000 |
| $Br^{-1}$ | 65 | 50- 5,000 |
| $I^{-1}$ | 0.05 | 1- 300 |
| $HCO_3^{-1}$ | ? | 0- 1,200 |
| $SO_4^{-2}$ | 2,700 | 0- 3,600 |

Since dilution in the open ocean would be immediate, any increases in salinity and concentration of minerals components would be detectable within 100 feet or less of the discharge point. Any deterioration of water quality caused by the addition of the formation waters is thought to be extremely localized.

Although the formation waters contain little if any dissolved oxygen, the receiving waters are rich in oxygen so that immediate dilution would result upon discharge. Actual lowering of oxygen levels of surrounding water would be very minute.

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[1]EPA, 1974.

[2]Approximate average composition of ocean water.

Estimates of drilling muds (Section III.A.1.) which may be discharged into the ocean range from 55,540 to 458,464 tons. It is estimated that approximately 10 percent of the mud used goes unrecovered; most remains in the bore hold but some adheres to the cuttings (Section III.A.1.). Drilling muds consist of clays, barite, and small amounts of organic and inorganic chemicals (Section III.A.1.). When added to ocean waters they can create turbidity plumes several hundred yards downstream from the point of discharge. The clays, barite and chemicals mix rapidly with the ocean water and are diluted several thousandfold within a few hundred yards.[1] All substances in the drilling muds to be used must be identified and their use must comply with EPA standards under the Federal Water Pollution Control Act, as amended. No direct ocean disposal of oil-based drilling muds will be allowed in the Mid-Atlantic, and any request for variance must be reviewed on a case-by-case basis by the USGS, pursuant to the Mid-Atlantic OCS Operating Orders (Section IV.A.1.).

Data concerning trace metal concentrations are highly variable depending on sampling techniques and physical parameters. However, by examining data concerning present concentrations of some of these metals in the Mid-Atlantic, and in current discharges to the Mid-Atlantic waters, an indication of the relative significance of potential heavy metal contributions of formation waters and oil may be gained. This information is displayed in Table III-25.

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[1]Zingula (Oral Testimony, Public Hearing, DES for Proposed OCS Lease Sale #40, 1976) found no plume beyond 1/8 mile (21 m) downstream from an Exxon platform in the South Timbalier field of the Gulf of Mexico, and pH of sea water had returned to that of fresh sea water 100 yards downstream of the platform.

Table III- 25. COMPARATIVE CONCENTRATIONS OF CERTAIN HEAVY METALS IN VARIOUS MEDIUMS

(in ppm)

| | Cr | Cu | Ni | V | Zn |
|---|---|---|---|---|---|
| ocean water[1] | .0005 | .003 | .007 | .002 | .01 |
| water column of[2] New York Bight--northern & southern areas | .003-.015 | .00023-.018 | .00072-.001 | NA | .0018-.038 |
| water column of[2] New York Bight Apex in vicinity of sewage sludge & dredged materials dump sites | NA | .0006-.047 | NA | NA | .0021-.190 |
| weighted average[2] concentration of ocean dumped sludge, EPA Region II, 5/1/73-12/31/73 | 63 | 60 | 9.5 | .75 | 160 |
| median concentrations[3] in produced waters | ND-.01 | ND-<1 | ND-.015 | --- | ND-<.01 |
| concentrations[4] in six crude oils | <.09-19.6 | .19-1.25 | 1.28-116.8 | 4.9-112 | --- |

NA = not available ND = not detectable

[1]from Goldberg et al. (1971) (See Table 4 in Appendix 9)
[2]Draft Environmental Impact Statement on the Ocean Dumping of Sewage Sludge in the New York Bight, February, 1976, Environmental Protection Agency, Region II.
[3]Taken from Rittenhouse, Fulton, Grabowski and Bernard (See Table III- in Section III.A.1.).
[4]From Filby and Shah (1971) (See Table 5 in Appendix 9).

Other sources of water quality degradation include the discharge of drill cuttings, treated sewage from the rigs and platforms, bilge from supply vessels, and the sediments resuspended during platform installation and pipeline burial.

Drill cuttings consist of the sand, shale, limestone, and so on, from the underground strata brought to the surface by the drilling muds. Once separated from these muds the cuttings will be washed to remove excess oil if oil concentrations are greater than 48 ppm.

They are discharged overboard, where they accumulate in a pile approximately 100 to 150 feet in diameter and a few feet high (these piles become much smaller over time after drilling ceases, and can become the habitat of benthic organisms). The wash water is shipped to shore for treatment. The estimates for this proposed sale indicate that a total of up to 1,570,673 tons of drill cuttings will be produced during the exploration and development phases (high case, a large find) over the 25-year life of these fields (Section III.A.1.).

In the case in which no commercial quantities of oil and gas are discovered as a result of this proposal, the only sources of pollution would be those associated with exploration (Section III.A.1.a.). These include the drilling muds that adhere to the cuttings from the exploratory wells, the drill cuttings themselves, any oil spills resulting from possible blowouts, the resuspension of bottom sediments by drilling activities, and the volume of bilge associated

with the exploratory support and supply vessels. (There have been no spills of greater than 50 barrels during exploratory drilling since 1969. USGS, Written Testimony, DES for Proposed OCS Lease Sale No. 40, 1976.) If no commercial quantities are found, there would be no problem resulting from production-associated oil spills, discharge of formation waters, and the burial of pipelines.

The treatment of sewage from rigs and platforms is also covered under the proposed OCS Orders. All waste water from toilets, kitchen, and laundry drains is collected in holding tanks and treated before release. Under existing OCS Operating Order No. 8, the effluent can contain 50 ppm or less of BOD, 150 ppm of suspended solids, and not less than 1.0 ppm of residual chlorine. Treated sewage, for the numbers of men on the rigs and platforms (Section III.D.1.a.), would not be expected to deteriorate the quality of the surrounding waters.

Bilge from crewboats and service and supply boats may be discharged though actual quantities and effects due to these sources cannot be predicted. All construction contracts, OCS Order #7, and Coast Guard regulations prohibit these activities, however.

Installation of platforms, pipeline burial, and other sea-bottom activities would cause resuspension of sediments, an increase in turbidity during the course of the activity and subsequent burial of some benthic biota (Section III.B.2.). In the case of pipeline

burials near shore, the problem of resuspension of toxic metals, pesticides, or other organic and inorganic compounds might be encountered if sludge or chemical waste dumpsites were to be traversed. These effects will be investigated more fully when pipeline corridor management studies are undertaken. As of now, for an estimated 100 to 570 miles of pipelines, we can expect 800,000 to 4,560,000 cubic yards of sediment to be disturbed (Section III.A.1.).

There is a possibility that OCS development could stimulate additional dredging in some nearshore areas. If tankers have to be used, they will make use of harbors that are already capable of handling vessels of their draft; no additional dredging would be required. However, if supply bases are established in coastal areas that are presently too shallow to accomodate the necessary vessels, additional dredging will be required and the local water quality would be temporarily degraded. However, building such supply centers would require permits from both the local authorities and the U.S. Corps of Engineers and would therefore be subject to control by responsible authorities. No estimate of actual volumes or their effect on water quality can be made at this time.

2. Biological Communities

Impacts on the offshore biological communities of the Mid-Atlantic area could occur from discharge of drill cuttings and formation waters, drilling muds, pipeline burials, and from spillage of oil. Oil spills, by far, pose the largest threat to the biota and could occur from pipeline ruptures, blowouts, explosions, and transportation accidents. The fate of hydrocarbons in the marine environment is discussed in Section III.A.3. Impacts on biological communities that might occur should the proposal be implemented are discussed in the following sections. It should be mentioned that the evidence for possible impacts on marine ecosystems is derived primarily from laboratory studies. Data from field observations for previous spills are, to a large extent, based primarily on initial visual observations. There are very few studies of long-term, sublethal effects.

## Uptake, Metabolism and Concentration in the Marine Food Web of Hydrocarbons and Heavy Metals

Very little is known concerning many of the subtler or synergistic effects which may result from the introduction of hydrocarbons and heavy metals, or increased levels of these substances as a result of the proposed sale. Following is a summary of how these substances may enter and be transported into the food web, and is summarized from Appendix 9. Appendix 9 includes discussions of the various studies which have addressed these effects.

### Petroleum Hydrocarbons

The various fractions of petroleum hydrocarbons which constitute crude oil, and the relative amounts and characteristics of these fractions are discussed in Section III.A.3. Amounts of petroleum hydrocarbons (PHC) which may be expected to enter the marine environment are described in Section III.A.2.

Marine organisms contain and synthesize hydrocarbons under natural conditions. Some of the biogenic hydrocarbons which are important to the survival of the organism can be the same as or similar to the PHC found in crude or refined oil. Crude oil and oil products are varied mixtures that contain molecules of different size in fairly even distribution ratios. Conversely, organisms possess specific biosynthetic pathways which favor the production of hydrocarbons in preferred and consequently narrower size ranges.

PHC's are rich in toxic aromatic hydrocarbons and cycloparaffins, as well as a fairly broad range of isoprenoid hydrocarbons. A narrow range of isoprenoid hydrocarbons are found in organisms. Olefins and alkenes are abundant in most organisms, but lacking in crude oil.

PHC may enter the marine food web by several means. Petroleum adsorbed to living or dead particles may be ingested. Uptake of PHC by the ingestion of prey species by other organisms which have accumulated PHC with body tissues can also occur. Another method is the uptake of dissolved or dispersed petroleum via the gills or body surface . The importance of several of these uptake methods is still largely unknown, but will vary with the species involved, the method of feeding and respiration of the organism involved, the habitat, state of the sea, and the petroleum itself. Evidence indicates that the majority of hydrocarbons enter molluscs, crustaceans, and fish via gill membranes. Uptake through the gills has been reported to lead to tissue damage in quahogs. Although ingestion of contaminated food and sediment particles may be important in marine mammals and some fish, its relative relationship to the transport across body surface membranes is still unknown. However, significant amounts of PHC have been shown to have been taken up and accumulated, at least temporarily, within the body tissues of most fishes and invertebrates during spills.

PHC primarily concentrates in certain organs such as the liver, gall bladders, and much of the nervous system. However, it has been demonstrated that hydrocarbons actually associate with the lipids.

Metabolism of hydrocarbons in marine organisms is not well understood. Research on microbial metabolism of hydrocarbons is in its early stages. It is impossible to predict with ease or accuracy the rate of microbial removal. However, it is known that microorganisms can degrade much of crude oil, particularly less toxic paraffinic components. Microbial degradation is primarily aerobic and relies on large amounts of oxygen. Temperature increases, because of a number of factors, may increase biodegradation. Ingestion of microbes can then lead to hydrocarbon uptake in higher trophic levels.

Degradation of sizeable quantities of aromatic and paraffinic hydrocarbons has been detected in marine fish and some marine invertebrates. Other benthic marine invertebrates, phytoplanton, and some zooplankton have been shown to be unable to oxidize either paraffinic or aromatic hydrocarbons. It is assumed that the liver or hepatopancreas is the site of hydroxylation and other detoxifying reactions.

Evidence both confirming and denying depuration of accumulated hydrocarbons has been presented. The evidence indicates that there may be two forms of hydrocarbon accumulation in bi-valve molluscs: 1) a short-term form where PHC are taken up rapidly and depurated completely or to background levels within several weeks to two months (inferred response during an oil spill) and 2) a long-term hydrocarbon burden accumulated in tissues that is not completely discharged (response to chronic exposure when primarily aromatic hydrocarbons are accumulated in lipids). Because they apparently have the ability to metabolize hydrocarbons, fish and marine mammals would probably not retain the residual hydrocarbon concentration as do the molluscs.

Depuration of accumulated hydrocarbons in molluscs and certain zooplankton is achieved by bile salts or some other natural detergents which emulsify the hydrocarbons and allow passage through the gut and into the feces or pseudo-feces. Fish make water soluble products from the hydrocarbons and the main avenue of discharge appears to be through the urine via the gall bladder and kidney. In mammals, aromatic hydrocarbons are also converted to water soluble products that go through the bile and into the feces and urine.

The possibility exists of some selective hydrocarbon buildup in the food chain in chronically polluted areas through molluscs which retain a portion of the toxic aromatic hydrocarbons. Greater than normal levels of aromatic hydrocarbons could be transmitted on to the next trophic level. The fact that the animals tested do acculate hydrocarbons in rather large quantities in a relatively short time indicates that temporary food chain buildup can occur. The naphthalenes, which are among the most toxic petroleum fractions, remain within the prey species the longest. If the temporary accumulation of naphthalenes reach high enough concentrations in predators for death to occur, the impact through the food chain would be less than if the classical biological amplification did occur.

Heavy Metals

Heavy metals occur naturally in sea water in relatively low concentrations. In the coastal zone, especially in estuaries, near river mouths or municipal discharges, concentrations may be much greater than natural background levels. Fourteen trace metals are known to be essential for animal life. They serve as components of enzymes, enzyme systems, activators, components of vitamins, hormones and respiratory pigments.

In offshore operations, petroleum, formation waters and drilling muds may contribute heavy metals and other trace elements. Concentrations in crude oil vary greatly. Nickel and vanadium are generally the most abundant metallic elements in crude oil, although cobalt, mercury, iron, and zinc can be abundant. Nickel and vanadium are known to occur in several colloidal materials covering broad molecular-weight and polarity ranges.

Formation waters may also contain heavy metals in various concentration ranges. Section III.A.1. contain a table indicating ranges and components of sample formation waters.

Drilling muds contain barite (barium sulfate) and ferrochrome lignosulfate. Through chromium is known to be toxic in certain elemental states when bound, in chemical compounds it is less toxic. It has been shown that in ferrochrome lignosulfate, the chromium is firmly chelated and is not likely to be removed fron the complex even by strong ion-exchange resins.

The International Decade of Oceanographic Exploration Workshop concluded that with the possible exception of lead, current levels of heavy metals in marine ecosystems are derived primarily from natural sources. (Natural sources include river water, windblown material from weathered rock and tectonically active ridges where

heavy metals are emitted in heavy brine.) In the Gulf of Mexico, the Gulf Universities Research Consortium concluded that all heavy metals observed in the water column were within ranges reported for oceanic waters, with the possible exception of barium. Once in the marine environment, concentrations of heavy metals are lowered by dilution and removed from sea water by precipitation, adsorption and absorption. Accumulation in marine organisms can occur by uptake and adsorption from sea water through gills, body surface or gut wall. The amount absorbed depends on may physical characteristics, as well as biological characteristics of the absorbing organism. Accumulation can also occur through ingestion of food containing heavy metals. Food sources for accumulation of heavy metals include those adsorbed onto suspended particles or plankton, heavy metal compounds that have precipitated into sediments and been ingested by deposit feeders, and heavy metals concentrated by organisms and preyed upon by other organisms in higher levels of the food chain.

Concentration factors in marine organisms (measured against that available directly from the organism's environment) range up to more than one million for the heavy metals.

The relative importance of uptake from water compared to uptake from food is still being studied and is by no means resolved for marine organisms. It probably varies because of factors mentioned above, for differnt elements and organisms as well as various relative concentrations.

Heavy metals are usually used in enzyme systems or stored in a particular body tissue, sometimes only temporarily. The storage location depends on the type of metal, form of the metal complex, method of uptake, species of organism and other factors. Storage sites for most organisms include digestive glands, muscle tissues, skeletal tissue and gills. Most metals of concern from the standpoint of possible contributions from oil and gas operations are a part of the biological catalyst system and include iron, copper, zinc, manganese, and cobalt (nickel, chromium, cadmium, and silver may follow these elements).

There have been few studies to date of the release or depuration of heavy metals from marine organisms to the marine environment. Although data on retention times are scanty, there are indications that metals concentrated in animal tissues are retained at significant concentrations for several months. Discharge of heavy metals from marine organisms can take place by ion exchange across cell membranes of gill and body surfaces, loss by molting exoskeletons that have concentrated heavy metals, excretion of heavy metals into the gut and loss by feces and excretion in the urine. All of these processes help an organism to regulate the concentration of heavy metals and other substances accumulated from sea water or food, but the extent and rate of their release is poorly known for heavy metals.

Many variables are involved in the uptake, storage, metabolism and release of heavy metals, and very little is known of their transport through the marine ecosystem.

There is ample evidence to indicate that heavy metals accumulate in the marine food web in a variety of organisms at various trophic levels and through a variety of paths of uptake. Most of the characteristics of heavy metals in the marine environment favor their magnification in the food web. They are relatively resistant to chemical and biological degradation. However, classical food web magnification is complicated, not only by the various uptake methods, but by the ability of some organisms to release heavy metals back to the marine environment.

There is evidence that heavy metal concentrations in petroleum, formation waters and drilling fluids can range from 10 to $10^5$ times the natural background levels of the open ocean. Therefore, events such as accidental massive or chronic oil spills, accidental loss of drilling fluids and the discharge of formation waters can introduce higher loads of heavy metals into the ocean. The introduced metals are then diluted by sea water, precipitated out, adsorbed on particles or other organisms and absorbed by some marine organisms, occurring around drilling platforms for the most part.

Therefore, there could be some uptake of metals especially by the sessile organisms around the platforms. It is not known to what extent this occurs and to what levels the heavy metals would concentrate in the water column, sediments or marine organisms as a result of petroleum operations. The only investigation conducted so far concerning effects of heavy metals from offshore petroleum operations indicated that concentrations of heavy metals in the water column were within the ranges for the metals in the ocean water, except for barium where the data were inconclusive, and a zinc gradient around the platforms probably due to the decomposition of the sacrificial covering of the platform legs.

a. Impact on the Plankton

OCS-related activities that may have an effect on plankton communities are oil spills, discharge of drilling muds and formation waters, and conditions resulting from the burial of pipelines. The literature indicates a fairly homogeneous mixture of phytoplankton and zooplankton throughout the area. The species that could be impacted upon due to the various activities resulting

from this proposal would for the most part, be the same throughout the area. The biomass, however, can vary according to location and time of year so the number of individuals adversely acted upon would vary depending on these two variables. Data indicates that the enclosed systems, such as Raritan Bay, Delaware Bay, Chesapeake Bay, Long Island Sound, and the smaller coastal embayments support the highest densities of planktonic species in the area and are especially high from late spring to fall. In the event that oil spills or dredging for pipelines should occur in the embayments or the nearshore areas during the high density months, mortality of individuals would be the greatest. In the case of spills, the literature indicates (Section III.A.2.) that offshore spills from the vicinity of the proposed lease tracts would probably not affect the nearshore or coastal environment. Since the proposal is anticipated to replace foreign oil imports, the amount of oil spilled as a result of tanker accidents is not expected to increase (Section III. C.1.). The probability of spills from pipeline breaks is given in Section III.A.2. and would be small for the area.

There is also a seasonality on the distribution and occurrence of the ichthyoplankton component. Some of the fish species characterized by planktonic larvae (versus demersal) that occur in the Mid-Atlantic area are summarized in Table III-26. The table summarizes those species whose planktonic larvae may suffer mortalities on a seasonal basis by an event such as an oil spill or from dredging activity as a result of this proposal.

Other commercially important species that may be impacted include the planktonic larvae of the surf clam, soft-shelled crab, sea scallop, American lobster, blue crab, rock crab, Jonah crab, ocean quahog, southern quahog, northern quahog, and American oyster.

Table III-26. Seasonal Occurrence of Planktonic Larvae for Some Fish Species

| Species | Winter | Spring | Summer | Fall |
|---|---|---|---|---|
| Atlantic herring<br>*Clupea harengus*<br>Nearshore <90 m | x | | | x |
| Menhaden<br>*Brevoortia tyrannus*<br>Coastal | | | x | |
| Smelt<br>*Osmerus mordax*<br>Coastal streams | | x | | |
| Silver hake<br>*Merluccius bilinearis*<br>Coastal | | | x | x |
| Atlantic cod<br>*Gadus morhua*<br>Nearshore <90 m | x | | | |
| Haddock<br>*Melanogrammus aeglefinis*<br>Nearshore | | x | | |
| Red Lake<br>*Urophycis chuss*<br>Nearshore <100 m | | | x | |
| White hake<br>*Urophycis tenuis*<br>Nearshore <100 m | | | x | |
| Atlantic silverside<br>*Menidia menidia*<br>Shallow bays and marshes | | | x | |
| Atlantic mackerel<br>*Scomber scombrus*<br>Indiscriminate | | x | x | |
| Butterfish<br>*Peprilus triacanthus*<br>Coastal | | | x | |

Table III-26. Continued.

| Species | Winter | Spring | Summer | Fall |
|---|---|---|---|---|
| Bluefish | | | | |
| *Pomatomus saltatrix* | | | x | |
| Offshore | | | | |
| Striped bass | | | | |
| *Marone saxatilis* | | x | | |
| Coastal streams | | | | |
| Scup | | | | |
| *Stenotomus chrysops* | | | x | |
| Inshore waters | | | | |
| Weakfish | | | | |
| *Cynoscion regalis* | | | x | |
| Nearshore and inshore | | | | |
| Cunner | | | | |
| *Tautogolabrus adsperus* | | | x | x |
| Coastal | | | | |
| Tautog | | | | |
| *Tautoga onitis* | | | x | |
| Nearshore and inshore | | | | |
| Summer flounder | | | | |
| *Paralichthys dentatus* | x | | | |
| Offshore | | | | |
| Yellowtail flounder | | | | |
| *Limanda ferruginea* | | x | x | |
| Nearshore <70 m | | | | |

The extent of damages that might occur to the planktonic community can be interpolated from several studies if the limitations discussed previously are kept in mind. For example, various investigators have reported on the effects of hydrocarbons on phytoplankton. Galtsoff et al. (1935), Mironov and Lanskaya (1969), and Strand et al. (1971) have reported that the presence of oil in the marine environment generally retards the growth of phytoplankton.

Mironov (1972) added that cell division in phytoplankton was retarded by crude oil concentrations of 0.001 to 1000 ppm. Hufford (1971) noted the effects of oil on phytoplankton after several days exposure. Hydrocarbons were found to inhibit cellular division thereby causing death. Cell membranes were also damaged which caused an extrusion of cellular content. Gordon and Prouse (1973), using concentrations of petroleum hydrocarbons more realistic to levels in the natural environment or near spills, found that at concentrations below 10 to 30 ppb, photosynthesis was stimulated. Concentrations of crude and refined oils from 60 to 200 ppb were found to suppress photosynthesis (Boesch et al., 1974). According to Boesch et al. (1974), Gordon and Prouse found that Number 2 fuel oil (characteristics of Number 2 fuel oil as compared to crude can be found in Section III.A.3.) has the greatest effect on photosynthesis and depresses it by 60 percent at concentrations between 100 to 200 ppb. There is good

indication that stimulation and/or depression of photosynthesis can occur. Stimulation of photosynthesis will most likely occur with lower concentrations of hydrocarbons or with lower sublethal dosages. These levels may be the case in areas peripheral to spills, or areas subject to chronic low level discharge such as from chronic pipeline leaks. For example, Raritan Bay, which has a high level of organic pollution, supports a standing crop higher than adjacent areas (Smayda, 1973). If there is tankering of crude oil as a result of this proposal, other similar areas, such as Delaware Bay could receive crude shipments. To the extent that increased amounts of hydrocarbons are introduced to these areas as a result of this tankering, further stimulation/depression of selected phytoplankton species in these areas could occur. In studies following the Santa Barbara blowout, Oguri and Kanter (1971) found no conclusive evidence of an adverse effect on phytoplankton productivity that could be attributed to the oil spill. Some kills, however, were reported in the phytoplankton following the Torrey Canyon crude oil spill (Smith, 1968). In this case, however, the use of chemical dispersants had complicated the assessment of adverse impacts resulting from the oil on the phytoplankton component (Boesch et al., 1974).

Oguri and Kanter(1971) report that the use of dispersants may result in a marked reduction in productivity. They report that the longevity of such effects would largely depend on currents and the rate of consequent dilution.

Little information exists as to the effects of crude oil on zooplankton. Hufford (1971) reports lethal dosages of diesel oil at 0.1 percent concentrations for 5 to 60 minutes. Some copepod species were also found to be sensitive to 1 ppm of fresh or weathered crude oil and diesel oil (Mironov, 1970). The Operation Oil Task Force (1970) reports in their study on effects of spilled Bunker C from the Arrow in Chedubucto Bay, Nova Scotia, that many copepods ingested small oil particles and later eliminated them. They also report that individuals ingesting smaller particles eliminated them within 24 hours with no apparent visual harm.

Smith (1970) reports no kills of zooplankton following the Torrey Canyon crude oil spill. McGinnis (1971) also reports no harmful effects on zooplankton populations in the Santa Barbara Channel after the Santa Barbara blowout.

As discussed in a previous section, the larvae and young of many benthic and fish species are components of the zooplankton. According to Boesch et al. (1974), Sponner (1971) reports that concentrations of crude oil at 100 ppm are fatal to larval barnacles. Crude oils have also been reported to be toxic to the planktonic eggs and larvae of some fishes, including cod and herring (Kuhnhold, 1969). TRIGOM (1974) reports that the sensitivities of fish larvae to hydrocarbons will vary depending on species and that, at this time, little is known about the effects upon them. A summary of the data available

is given by Moore, Dryer and Katz (1973). The meroplankton (planktonic for part of their life cycle) are generally considered to be sensitive to environmental stress and would be especially vulnerable to oil spills since many (depending on species) are concentrated near the surface of the ocean. Massive kills of planktonic larvae could be expected with large oil spills. Table III- 26 refers to some species of fish whose larvae are susceptible to damage. Damage to the year class strength of certain species of fish could occur as well as with populations of benthic organisms. However, a massive spill will still affect only a relatively small area. It is thought that distributions and species survival will not be permanently affected due to the high reproductive potential and numbers of larvae associated with these species. Changes in distribution and populations would, for the most part, be localized.

The discharge of formation waters or brines would also impact on the same planktonic populations only offshore where production takes place. Formation waters contain no dissolved oxygen, contain a high concentration of dissolved salts, may contain traces of heavy metals (Table III- 24) and usually maintain traces of hydrocarbons even though they are treated. The release of this water would result in a plume from the point of discharge in the direction of the current. The plume will probably be lethal to planktonic organisms where brine concentrations are higher around the discharge point. Direct toxicity is reduced since formation

waters are diluted within a short distance from point of discharge depending on the characteristics of the currents of the area. Lethality can result from low dissolved oxygen levels and osmotic imbalance resulting from cells losing water to the brine. There is no evidence of stimulation (increased productivity) from formation waters for planktonic organisms.

Turbidities resulting from the discharge of drilling muds and cuttings and the burial of pipelines would impact planktonic communities on a localized basis. The turbidities resulting from the various operations are visible as plumes in the direction of the current until they become diluted and disappear or settle, usually within a range of a few yards to less than a mile from the source. Turbidities within a given area are of short duration and, at most, last up to a few hours. Turbidities may also occur in nearshore areas as a result of runoff from the construction of onshore facilities (Section III.D.2.e.).

The effect of turbidities on the light-dependent phytoplankton would be to suppress photosynthesis by obstructing the penetration of sunlight. High turbidity levels may also have a smothering effect on zooplankton by clogging their filter feeding mechanisms and thereby decreasing filtering and feeding efficiency. Turbidity may damage plankton populations by physical abrasion and reduced egg buoyancy. Another possible impact from increased turbidity is toxicity to organisms due to resuspension of metals and pesticides and other organic pollutants maintained in the sediments.

Drilling muds and cuttings discharge could clog the filter-feeding mechanisms of various organisms. The chromium content of these discharges could be a toxic pollutant with the potential for affecting the nekton. However, the severity of this effect is unknown. Further discussion of influences of heavy metals on marine organisms can be found in Appendix 9.

Since it is anticipated that pipeline activities will most likely take place off New Jersey, with a lesser possibility off Delaware and Maryland, planktonic communities liable to be impacted will be those which are found in that particular area (for a discussion of general pipeline corridor locations, see Section III.D.1.a.). The extent of damage would be dependent upon the season of activity, as discussed earlier. General phytoplankton species likely to be among those adversely affected that may be located in these areas are summarized in Table III-27. Zooplankton species are presented in Table II-31 through II-39.

A detailed discussion of the processes and influences of petroleum hydrocarbons and heavy metals on marine food webs is included in Appendix 9.

Our conclusions concerning the impacts of this proposal on the plankton of the Mid-Atlantic are as follows:

Oil spills--The studies mentioned previously indicate that the planktonic populations of the Mid-Atlantic area will be able to withstand the impacts of a major oil spill and recover fairly

Table III-27. Some of the Major Phytoplankton Components of the Continental Shelf in the Mid-Atlantic area

| | W | S | S | F | Maximum cells/l |
|---|---|---|---|---|---|
| Diatoms | | | | | |
| Skeletonema costatum | x* | | x | x | $300 \times 10^3$ |
| Chaetoceros socialis | x* | | | x | $275 \times 10^3$ |
| C. wighami | | | x | | |
| C. debilis | x | x* | | | |
| Asterionella japonica | x* | | | x | $140 \times 10^3$ |
| Thalassionema nitzschioides | x | | x | x* | $100 \times 10^3$ |
| Rhizosolenia faeroense | x | | | | $25 \times 10^3$ |
| R. alata | | x | | | |
| R. spp. | | | x | | $13 \times 10^3$ |
| Thalassiosira nordenskioeldii | | | x | | $50 \times 10^3$ |
| Leptocylindrus danicus | | | x | | $50 \times 10^3$ |
| Nitzschia seriata | x | x* | | | $18 \times 10^3$ |
| Cylindrotheca closterium | | | x | | $15 \times 10^3$ |
| Guinardia flaccida | | | x | | $8 \times 10^3$ |
| Coscinoscira oestrupi | | | x | | $3 \times 10^3$ |
| Dinoflagellates | | | | | |
| Prorocentrum micans | | | x | | $3 \times 10^3$ |

* Denotes time of peak densities (Adapted from TRIGOM, 1974)

rapidly. Damages caused by a spill, to a large extent, will be determined by variables, such as currents (dilution factor), time of year, and where they occur. Depending on crude oil concentrations, phytoplankton have been demonstrated to be either stimulated (productivity) or killed. A similar situation is indicated for the zooplankton component. Massive kills can be expected in the immediate area of a spill. The planktonic organisms most susceptible to adverse impacts from spills are those associated with the surface layers of water.

Available evidence indicates that the nearshore environment supports a higher density of planktonic organisms, especially during certain times of the year(Section II ). Densities are highest during spring to fall. Spills during those seasons, nearshore, will have the greatest adverse impacts in terms of the number of individuals killed. Spills affecting the nearshore environment will largely occur from pipeline or tanker accidents. Nearshore spills from pipelines would be most likely to occur north of the Maryland-Virginia state line, most likely off the New Jersey coast. Damage to the year class strength of fish species having planktonic larvae and certain benthic organisms could occur on a regional basis. They would most likely, however, be temporary in nature in the order of no more than one complete reproductive cycle. Again, the species affected will depend on time of

year and location of spill. These larval kills will be the highest nearshore and from late spring to early fall and they should not be extensive enough to seriously deplete any fish stock.

Continuous oil spills occurred in the Mid-Atlantic region during World War II. No irreversible or permanent damage to the planktonic community has been reported (Section II.G.3.).

Discharge of formation waters--Formation waters will be most harmful and lethal to the plankton in the immediate area of discharge. Discharge plumes may vary in length from a few yards to less than a mile, with toxicity dependent on the components in the formation water and on the dilution factor. Adverse effects as discussed previously can result from high concentrations of dissolved salts, possible traces of heavy metals, and low levels of dissolved oxygen. An unknown effect could be the biological uptake of water soluble aromatics not removed in the separation process. Since the discharge of formation waters is associated with production, the nearshore environment will not be affected as the proposed area for leasing is located 47 to 92 miles offshore.

Pipeline burial and discharge of drilling muds and cuttings--Impacts upon the plankton resulting from increased turbidity are decreased rates of photosynthesis, smothering, and a decrease in filtering and feeding efficiency. These impacts are expected to be localized,

temporary, and of low severity as discussed previously. Turbidity resulting from pipeline burial is applicable nearshore and offshore across the Continental Shelf, while dishcarge of muds and cuttings is applicable to the offshore, proposed leasing area.

Chronic low-level discharge--Little is known of the sublethal impacts upon the planktonic community other than the fertilizing effect of sublethal dosages of hydrocarbons upon the phytoplankton. The hydrocarbon uptake and the carcinogenic problems they may present are also little know. A discussion of some of the processes involved in food chain dynamics and impacts of hydrocarbons and heavy metals is presented in Appendix 9.

b. Impact on the Benthos

Environmental impacts on the benthic community may occur from oil spills, discharge of drilling muds and fluids, increased runoff from onshore, and from the burial of pipelines. A discussion on how spilled oil becomes associated with the benthic realm is presented in Section III.A.3.

Fauna

Subtidal

The subtidal fauna in the Mid-Atlantic area varies according to substrate type. Within a given substrate type, depending on depth, the dominant groups of organisms represented remain the same. Faunal groups found in deeper waters will be less susceptible to the toxic effects of spills due to the increased dilution associated with depth. Dominant members of this group are echinoderms, polychaetes, and bivalves. Nearshore assemblages, such as the sand fauna, silty-sand fauna, and those associated with lagoons and estuaries, are most directly liable to impact from spills. Spills affecting these areas as a result of this proposed sale would likely occur nearshore and result from pipeline or tanker accidents.

Impacts upon benthic communities resulting from turbidities can occur both nearshore and offshore in the proposed area of exploration and development. Turbidities nearshore can result from pipeline burial activities and increased onshore runoff (Section III.D.2.e.) and offshore from burial of pipelines and the disposal of cuttings and muds.

The types and extent of impacts upon benthic communities that can result from this proposal are documented in the literature. Observations on the effects of oil spills on benthic communities were made following the Tampico Maru and Torrey Canyon spills. According to North et al. (1965) extensive kills of Pismo clams, abalones, starfish, sea urchins, lobsters, and other benthic invertebrates occurred in the area of the spill from the Tampico Maru (Boesch et al., 1974). Boesch et al. (1974) also report that due to the persistence of oil on this site and the resultant imbalance from the reduction of grazing invertebrates and predators, recovery could not be reported seven years after the spill. Large fatalities of molluscs, crustaceans, and echinoderms were also reported following the Torrey Canyon spill (Smith, 1968). The actual effects of the oil, however, were difficult to assess in this case due to the toxic dispersants that were applied. Little is known concerning the effects of this oil or its persistence in the bottom sediments (Boesch et al., 1974).

Sanders, Grassle, and Hampson (1970) also report the fatalities following the spill of Number 2 fuel oil near West Falmouth, Massachusetts. In heavily oiled bottoms, the benthic fauna was almost completely eliminated and in peripheral areas, the more susceptible forms were also killed. Evidence indicates that the oil spread from shallow areas to deeper ones over the course of a year following the spill and thereby contaminated new areas.

Bivalve molluscs were reported to be especially vulnerable. It is reported that whenever levels of hydrocarbon decreased below a toxic level, affected areas are first recolonized by more resistant forms like the polychaetous worm Capitella capitata. This occurred within a three to six month period after the spill. In a ten to twenty month period, the more sensitive molluscs resettled many areas. Locations receiving large amounts of oil had not been resettled after a twenty month period by more sensitive forms as ampeliscid amphipods. Reasonably complete recovery is estimated at five to ten years (Boesch et al., 1974).

Blumer, Souza, and Sass (1970) reported from chemical analyses of edible shellfish species made following the West Falmouth spill, that the fuel oil had been absorbed or ingested and could be found in oyster bodies and scallop muscles.
Blumer and Sass (1972) later added that oysters affected by the West Falmouth spill and later kept in uncontaminated water still retained petroleum hydrocarbons for over eight months.

Ehrhardt (1972) also reported heavy contamination of oysters in Galveston Bay, and concluded that organisms accumulate the entire range of hydrocarbons to which they are exposed.

Other investigators have also reported the tainting of shellfish species. Clams (Hawkes, 1961), oysters (Menzel, 1948; St. Amant, 1970), and mussels (Galtsoff et al., 1935; Nelson-Smith, 1972) have been reported to be tainted.

More recently, various investigations have reported that contrary to Blumer et al., while shellfish will accumulate hydrocarbons from solution, they will eliminate them in a fairly short time when placed in uncontaminated seawater (Lee et al. 1972; Anderson, 1973). Boesch et al. (1974) report that the process of uptake and of decomposition are complex and varied and probably depend to a large extent on dosage, storage sites, and even the species involved. A more thorough discussion of uptake, accumulation and food chain dynamics may be found in Appendix 9.

According to Fauchald (1971), the biomass of the echiuroid Listriobus pelodes in the Santa Barbara Channel decreased after the spill. However, since their populations were decreasing prior to the spill, he could not attribute the decrease directly to the spill. Other species, such as the brittle star Amphiodia urtica, showed a similar decline (Wintz and Fauchald, 1971). The Santa Barbara oil blowout is suggested as a possible reason for the decline in their populations along with increased sewage pollution, drilling, and change in sediments.

In box core samples taken the following spring and summer at Santa Barbara in heavily oiled sediment, Juge (1971) found no burrowing organisms or evidence of them. From the same samples, Fauchald reports the occurrence of a small L. pelodes.

Scarratt and Zutko (1971) report no lethal effects in the subtidal benthic community following a spill of Bunker C fuel at Chedabucto Bay but found contaminated animals 26 months after the spill.

Drill cuttings are separated from the drill mud and discharged into the ocean where they usually accumulate on the ocean floor in piles 100 to 150 feet high (these piles become much smaller over time after drilling ceases). Section III.A.1. discusses the extent of cuttings anticipated for this proposal. A survey offshore Louisiana revealed drill cuttings deposits to be inhabited by benthic organisms.[1] Undoubtedly, depending on cutting type, smothering of some benthic forms may occur, especially with epibenthic communities. At the same time, however, colonization and repopulation can occur, although species different from the original one may occur. The extent and duration of the shifts and impacts on various trophic levels are difficult to predict at this time.

Associated with the dumping of drill cuttings is the disposal of drill muds. The barium and chromium in drilling muds is thought to be harmful to marine biota, but its effects to date have not been determined. Jones and Williams (1973) found barium compound levels to be above normal in sediments off Louisiana where drilling has been carried on for many years. He reports

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[1] H. Hill, Continental Oil Company, personal communication, 1975, and Zingula (Oral Testimony, Public Hearing, DES for proposed OCS Lease Sale #40, 1976).

that barium levels were low enough to present no known biological hazards. Additional data on the effects of trace metals is presented in Appendix 9.

The pipeline burial process physically disrupts the sediments and causes resuspension of large quantities of sediment. The benthic fauna in the jetting path could be destroyed or left exposed. Recolonization is expected to begin shortly thereafter but would require at least one reproductive cycle for the native fauna to begin restoration in the affected area. Increased turbidity resulting from pipeline burial and onshore runoff is also capable of producing adverse effects on filter feeding organisms by decreasing their efficiency or by interfering with their respiration.

Another possible source of impact during pipeline dredging is the resuspension of toxic heavy metals and pesticides, which are primarily associated with various types of dump sites and various outfall areas. The possibility exists that these toxic materials could be ingested by lower forms and then magnified through the food chain until they accumulate in serious quantities in harvested species. There is no conclusive data on this subject at the present time. However, BLM will conduct pipeline corridor studies to assure that corridors with the least possible potential environmental impact are utilized.

In summary, our conclusions concerning impacts on the subtidal benthic communities are as follows:

Oil spills--A large oil spill with a maximum amount of sinking oil would be the most detrimental to the subtidal benthic community. This can occur nearshore from pipeline breaks or from tanker accidents. Spills further offshore could occur from production areas, although sinking of oil would not be expected in the immediate spill area.

Previous studies have shown that impacts can range from extreme destruction to minor or undetermined effects to benthic communities. Nearshore areas have previously been shown to suffer the greatest losses. If a spill should occur, as a result of this proposed sale, high mortalities can be expected. This will especially be true for more sensitive and exposed forms, such as the epibenthic community. In previous spills involving crude oil, mortalities were more apt to be due to smothering organisms rather than to direct toxicity. The smothering of organisms is less likely in open and dynamic areas. This especially applies to the Mid-Atlantic area where open beaches are prevalent. While initial adverse impacts may be high in the spill site and areas of spread, recovery is expected to occur in a short time. A possible example would be the recovery which occurred from continuous tanker spills during World War II (Section II.G.3.).

Geographic areas most susceptible would be along tanker routes (possibly into New York Harbor or Delaware Bay and, more remotely, Chesapeake Bay) and pipeline routes (possibly into New Jersey, Delaware or Maryland). For a discussion of probable and general pipeline locations, refer to Section III.D.1.a.

Drill cuttings and pipeline burial--Drilling and pipeline burials could cause both smothering and burial of benthic organisms. Epibenthic organisms may be especially susceptible. Pipeline burial could result in community disruption and destruction in the path of a pipeline corridor.

Recovery in both cases is expected to begin within months or within one complete reproductive cycle of a particular species. Biological recovery, especially for epifaunal communities, will take a longer period of time.

Turbidities associated with both offshore operations and onshore runoff from OCS-related construction activity (Section III.D.2.e.) are likely to affect filter feeders by decreasing their efficiency and respiratory processes. Resulting impacts are expected to be localized and restricted to the area of discharge. In the case of pipelines, as previously stated, routes are anticipated off New Jersey and possibly off Delaware or Maryland (Section III.D.1.a.).

Trace amounts of barium and chromium may be periodically released along with the drilling muds. While barium and chromium are known to have harmful effects on the terrestrial biota, the literature, as mentioned previously indicates that their levels in the marine environment, resulting from drilling muds, should not reach toxic levels. Conclusive data, however, is lacking at this time. Resuspension of heavy metals and pesticides contained in the sediments may occur from pipeline jetting if burials should occur in highly contaminated areas as outfalls and dump sites. Direct kill to benthic organisms is not likely to occur but accumulation, especially pesticides, into the food chain can occur and concentrate in higher forms (see Appendix 9 ).

Intertidal

The intertidal fauna primarily represented in the Mid-Atlantic area is the beach fauna and to a lesser extent, the

fauna associated with "hard" substrates as with manmade structures(for example, jetties, docks, and groins). The literature indicates (Section III.A.4.) that nearshore spills pose the largest threat to the intertidal fauna, while offshore ones, especially in the proposed area of production, do not. As indicated earlier, nearshore spills will most likely occur from tanker accidents and pipeline spills.

Impacts upon intertidal communities from previous spills are well documented. According to Boesch et al. (1974), oil can smother, foul, or directly poison intertidal organisms. The effects of oil poisoning, from the literature, indicates that it varies from "nonexistent" to "extremely damaging." The differences, to a large extent, are due to the particular physiographic and biological intertidal community affected and the type of oil spilled which, in turn, determines both the toxicity and the degree of contact with fresh oil slicks (Boesch et al. 1974). Ebeling et al. (1970) also report that toxicities to intertidal organisms differ according to the type of crude oil.

Intertidal animals can be killed in a number of ways. Most investigations have shown that direct toxicity is rather rare (Boesch et al. 1974). Devastating toxic kills are reported for the Tampico Maru spill on a rocky shore into a cove having restricted circulation and at West Falmouth (North et al., 1965; Shipton et al., 1970). Almost all intertidal organisms were killed with

the exception of high spray zone dwellers and resistant anemones at the site of the Tampico spill which involved diesel fuel.

The spill of Number 2 fuel oil at West Falmouth also resulted in a high number of mortalities among intertidal and beach fauna. Mortality was almost nearly complete with only a few polychaete worms remaining. Sanders (1973) reported that species density patterns for polychaetes, gastropods, bivalves, and ampeliscid amphipods, which are residents of the subtidal benthos, follow stress patterns depending on distance from the spill and time of exposure of organisms to the fuel oil.

More commonly reported are nontoxic effects on intertidal organisms which is usually the case for crude or heavy fuel oil spills. Crude oil from the Torrey Canyon spill caused mortalities in the intertidal and beach fauna. The usage of detergents at the site to disperse oil, however, made the assessment of damage caused by the oil difficult. North (1973), however, reports indications were that mortalities were light where detergents were not used.

Chan (1972) determined for a Bunker C fuel spill at San Francisco that organisms died from being smothered by the oil with certain species as acorn barnacles and limpets suffering the highest mortalities. There was a significant decrease in reef life after the spill. Some mobile species as snails suffered less mortality than sessile forms as barnacles which were completely covered by oil.

This was also reported at the Santa Barbara spill (Nicholson and Climberg, 1971; Foster et al., 1971). Other mobile species such as limpets were cemented to rock surfaces. The communities impacted in both the Tampico and San Francisco Bay spills eventually repopulated, indicating that the oil spills did not permanently damage these types of impacted intertidal areas.

Most spill studies in the intertidal are concerned with rocky shorelines. Relatively few have dealt with sandy beaches.

Trask (1971) studied the effect of oil on sandy beaches following the Santa Barbara spill. He formed no definite conclusions, however, due to the lack of previous data and winter faunal conditions. Straughan (1972) arrived at a similar conclusion. By the time the oil reached the beaches, the lighter fractions had evaporated and the oil was too heavy to penetrate into the sand. This, coupled with low winter community populations and sparseness of sand on beaches, prevented greater loss of the beach community.

Number 2 fuel oil spilled at West Falmouth and Bunker C spilled at Chedabucto Bay reportedly had severe effects on sheltered intertidal animals (Sanders et al., 1972; Thomas, 1973). Oil at both locations persisted in the sediment for several years, whereas in exposed areas, the intertidal zone can be expected to be cleansed within a short period due to wave energy.

Chan (1972) reported a sharp reduction of fauna on a sandy beach oiled during the San Francisco Bay spill. A nearby beach which had not been oiled also experienced a similar reduction so the oil spill could not be implicated for the population reduction.

The impact from pipeline burial operations in intertidal communities is expected to be slight except at the actual site of pipeline burial. At these sites, almost complete disturbance of the intertidal community for 5 to 10 feet along the pipeline can be expected. Long-term damage to the community is not expected with recovery most likely occurring after burial activities are terminated. A potentially harmful impact would be from intertidal sedimentation from polluted sediments stirred up during pipeline laying. The consequence of this, although believed to be minor in relationship to the total of intertidal communities, is not known.

In summary, our conclusions are as follows:

Oil spills--The initial damage caused by a large crude oil spill on intertidal areas can be severe, especially with fauna associated with hard substrates. This fauna, however, is scarce in the area so the overall impact upon them will be minimal. Sandy beaches dominate in the Mid-Atlantic area and damages to this type of community have been found to vary. Although initial mortalities on this type community can be high, long termed impacts are not

anticipated for the Mid-Atlantic area. Previous spills involving crude oil on high energy beaches have shown the least amount of adverse impacts, especially during the winter months. Spills which occurred during World War II from tanker accidents also recorded no permanent or long-term impacts (Section II.G.3.). This has not been the case for enclosed areas, however, and high mortalities can be expected in wetland and estuary areas.

When the initial impacts of oil spills on the intertidal fauna have been severe, communities have been known to recover within a few years. As Boesch et al. (1974) and others have concluded, the intertidal community is resistant and resilient due to the hardiness of the intertidal organisms, their rapid reproduction, and the relatively rapid removal of oil from the intertidal zone by wave action. It is also pointed out that cleanup techniques, such as the use of toxic dispersants and steam cleaning, often do more harm than good and should be stringently controlled and discouraged.

Pipeline burials--Impacts resulting from pipeline burial activities are expected to be localized within the intertidal fauna community and temporary in nature. Site disturbances can be expected to occur from pipeline burial operations for 6 to 12 feet along pipeline routes. Recovery is expected to occur soon after burial activities are terminated.

## Flora

Due to the unsettled substrate types found in the Mid-Atlantic, the region is poorly represented floristically. Algae distributions are scattered and sparse along the entire coast with larger populations found in protected areas with hard substrates.

The literature indicates that some marine algae are resistant to oil, especially those having a coating of mucilage. Subtidal forms fared well after the Santa Barbara spill with little oil adhering to their surfaces (Boesch et al., 1974; Foster et al., 1971).

Intertidal forms are generally resistant to oil but suffer mortality when they are coated with oil or torn from the substrate. Even though algae may be initially killed by spilled oil, their reproductive characteristics and rapid growth allow them to recolonize impacted areas rapidly after disturbance. In situations where herbivores are eliminated, recolonizing can be expected to occur more rapidly with succession beginning with the green algae and followed by brown forms (Nelson-Smith, 1974). In cases where the brown forms are not grazed upon and consequently form thick beds, recolonization of fauna assemblages may be delayed.

Anderson et al. (1973) report, following the Tampico Maru spill, that "the marine flora appeared to be damaged only slightly, if at all." Thomas (1973) reported, following the Chedabucto Bay spill of Bunker C., that the brown alga Fucus declined over a

ten month period following the spill and that recovery had not been successful at the time of his publication. Algae impacted from the Torrey Canyon later recovered in the absence of grazing herbivores.

The effect of oil spillage or leakage on eelgrass is not well known. Duncan (1933) stated that crude oil spillage from shipping reduced eelgrass stocks in England. However, Cotton (1933) refuted that the damage was done by oil. A study on a tropical seagrass (Thalassia) claims severe damage to the grass was caused by oil spillage in Puerto Rico and that the effects were residual and long-lasting (Diaz-Piferrer, 1962).

Impacts from pipeline burial activities are expected to be greatest in the area of burial (6 to 12 feet along pipeline routes). Organisms in the pipeline path, both offshore and nearshore will be physically disturbed and removed but recolonization will most likely occur rapidly after the activities are terminated. Suspended sediments and associated turbidities are not expected to impact most subtidal forms. Even though sunlight penetration and consequently photosynthesis can be reduced in localized areas adjacent to activity sites, impacts resulting from reduced sunlight are generally not expected to occur. There is a possibility that eelgrass may be adversely affected by deposition of solids temporarily suspended during pipeline burial. In Newport Bay, California, eelgrass was greatly

reduced in abundance due to deposition of substrate material following the disturbance of the bottom by dredging (Stevenson and Emery, 1958).

In summary, our conclusions are as follows:

Oil spills--Oil spills will most likely have a minimum impact on the marine algae of the area. Most species have coatings of mucilage which, in previous spills, prevented oil from adhering to thalli surfaces thereby minimizing kill.

Seagrasses, however, may be adversely impacted. Intertidal forms on spill sites can be eliminated but evidence indicates that they will re-colonize rapidly, especially in the absence of grazing herbivores. The Mid-Atlantic area, due to lack of suitable substrate, generally lacks significant beds of subtidal benthic forms.

Pipeline burial--Impacts can be expected to occur along pipeline burial routes. Damage that can result is physical removal of those individuals on the immediate activity site and damage to eelgrass beds resulting from turbidity. The burial activities are short term and not long enough to interrupt the photosynthetic processes.

c. Impact on the Fish

Several investigators have reported on the effects of oil on fish. Direct lethal effects are reported by Tendron (1969) who observed a decrease in their numbers in the English Channel following the Torrey Canyon spill. Due to the usage of dispersants

after the spill, however, the actual effects of oil could not be made. It is reported, however, that 50 to 90 percent of pilchard eggs were dead and young pilchard were also very rare (Smith, 1968). According to Boesch et al. (1974), fish kills were observed after a crude oil spill in Puerto Rico (Diaz-Piferrer, 1969), a spill involving a variety of fuel oils at Wake Island (Gooding, 1971), and at the West Falmouth fuel oil spill (Blumer et al., 1971). Conversely, Eberling et al.(1970) detected no effect on fish communities following the blowout at Santa Barbara. The California Department of Fish and Game (1969) also reported no damage to fish populations resulting from oil contamination after trawl samples and sonar transects. From diver operations, the Department reported that fish reacted to the surface of oil as if it were a floating kelp bed.

A variety of laboratory studies report on the toxicities of oil and refined petroleum products to fish. Laboratory studies have their limitation, however, in assessing impacts due to the vast differences between aquaria and the ocean plus the fact that oil concentrations in the water during a spill are rarely known. North et al. (1965) and Eberling et al. (1970) have reported that fish may be less vulnerable to spills that other groups because they may simply move away from areas contaminated by oil. Rice (1973) has noted that in laboratory studies, pink salmon fry are able to detect low concentrations (as low as 1.6 mg/l) of Prudhoe

Bay crude and show avoidance behavior to it. Nelson-Smith (1971) has also reported that fish seem to avoid contaminated areas. Fishes also may be more resistant to oil than other organisms due to their coating of slimy mucus (Boesch et al., 1974).

Hufford (1971) cites several early studies which show that crude and bunker oils harmed or killed fish eggs. Concentrations of crude oil at 1 ppm were found to be toxic to anchovy, scorpionfish, and sea parrot eggs, and oil was found to affect fish respiration by clogging gills and damaging gill tissue (Mironov, 1969, 1970). Blanton and Robinson (1973) supported Mironov's findings. They found gill damage to specimens of seven species of fish exposed to a Louisiana and a Texas spill.

Morrow (1974) reported mortalities to young coho and sockeye salmon when crude oil poured on the water surface reached 500 ppm or greater. When fish were force-fed oil at 1 gm per 100 gm of body weight, dipped into an oil film, or had a drop of oil placed on each gill, they showed no significant mortalities. He suggested the toxicity of unsaturated aromatic compounds probably results from alteration of cell membrane permeability, especially in the gills, by dissolution of fatty substances from them. This, in turn, destroys the ability to regulate salt balance.

As described in a previous section, some fish larvae are concentrated in the upper layers of water. The larvae could be exposed to direct kill from water soluble fractions of hydrocarbons, but would also be vulnerable to starvation in the event of a massive spill that killed off their food supply of phytoplankton and zooplankton. The year class strength could be damaged. Additional ichthyoplankton and spawning data are given in Sections III.B.2.a., II.F.1.b., and II.F.1.d.

The sublethal effects from oil pollution, especially from the chronic low-level discharge of oil into the marine environment, are the least known and potentially the most dangerous to fish. Sublethal effects are often subtle and may not be known until damage to the population is widespread. Sublethal levels of crude may occur as a result of this proposal in offshore production areas or inshore terminal areas. Feeding, reproduction, and social behavior in fish and lobsters have been shown to be disrupted by soluble aromatic derivatives as low as 10-100 parts per billion (Todd et al. 1973). Interference with predator detection of prey is also possible. Whittle and Blumer (1970) report that predators are attracted to prey at the part-per-billion level. This low-level interference could also disrupt migratory and homing detection (Nelson-Smith, 1973).

Blumer (1969) has proposed that physiological/behavioral effects may interfere with fish nutrition by:

(a) blocking taste receptors, and

(b) mimicking natural chemical messengers which attract predators to their prey.

Boesch (1973) cited that unpublished work of Todd and Atena (Woods Hole Oceanographic Institution, Chemotaxis Group). They worked with behavior patterns of yellow bullheads, Ictalurus natalis, and found that the fishes' complex, chemically-mediated social behavior developed high intensity conflict behavior when exposed to water soluble fractions of Kuwait crude oil. These sublethal effects may possibly affect fish populations in the Mid-Atlantic area but conclusive data is lacking at this time.

Other activities that could have an impact on fish populations are the discharge of formation waters, drilling muds and cuttings, and the disturbances due to pipeline burial and platform construction. Fish populations will probably not be affected by the heavy brine content of the formation waters and their low oxygen content since they would be able to avoid the local areas of discharge (Rice, 1973; Nelson-Smith, 1970) and discharges would be rapidly diluted when released into seawater.

A more severe effect might be the uptake of water soluble aromatics which might be found in the discharged formation waters. These water soluble aromatics are not removed in the separation process, and they could be a source for chronic low-level discharge of oil.

Drilling muds and cuttings discharge could clog the feeding mechanism of some species, but if this should occur, it mostly likely will be concentrated locally around the area of discharge. Trace amounts of metals associated with formation waters as well as those contained in drill muds are expected to be released. The literature indicates that barium levels in the marine environment, resulting from drilling muds, should not reach toxic levels. Conclusive data, however, is lacking. Barium is thought to be harmful to the terrestrial biota, but its effect on the marine environment is not known at present. Additional data regarding trace metal uptake is given in Appendix 9.

The impact of pipeline burial would be to localized to pipeline routes and might disturb the habitat and food sources of some demersal fish on a very localized basis as discussed previously. The demersal fish feed largely on benthic organisms, and the greatest threat to their food source would be burial and construction activity in the areas of bottom sediment pollution which would be

resuspended into the water column. Harmful substances, such as pesticides, could be taken up into the benthic community which could serve as a link for passing the pollutants on to the bottom-feeding fish. Additional food chain uptake data is given in Appendix 9 .

In summary the possible impacts from this proposed sale are as follows:

Oil spills - Previous studies indicate that if a spill should occur, fish kills can be expected. The number of fatalities most likely, will vary according to size of spill, type of crude, time of year, and species of fish. Laboratory studies have indicated that fish can avoid contaminated areas, and consequently avoid spills. Low dilutions, however, can have physiological and behavior effects on them. They can interfere with fish nutrition, social behavior, migration, and homing behavior. Additional chronic and low level impacts appear in Appendix 9 .

Spills could have their greatest impact in the nearshore areas where fish populations are the highest. Spawning also occurs in the nearshore areas for many species. As previously stated, nearshore spills resulting from pipeline or tanker accidents pose the largest threat. Anadromous species like striped bass, shad, and some herrings which are dependent upon a few remaining fresh

water systems as found in the Delaware and Chesapeake Bays, and fish requiring estuaries for part of their life cycle face the greatest threat if nearshore spills occur in these locations during the spawning season. Spills at this time of year could prevent eggs from hatching or kill fry. If such spills are extensive enough, whole year classes of fish from the affected spawning ground could be decimated or even eliminated. Section III.B.2.a. contains additional data on possible impacts to fish populations.

Discharge of formation waters--Discharge of formation waters could alter or produce local water quality changes which would probably be avoided by fish. The effect of water soluble aromatics not removed in the separation process might be harmful at sublethal levels. Additional data is presented in Appendix 9.

Discharge of drilling muds and cuttings, turbidities from onshore runoff due to OCS-related construction activity, and the effects from pipeline burial-- Local effects as discussed previously are expected to occur which could result in decreasing feeding efficiency and disturbance of respiratory processes. Habitats and food source for some species of demersal fish can also be disturbed but also on a localized basis. These areas would probably be avoided by fish especially in the area of discharge. More severe effects, though subtle, could be the toxicities to fish of trace metals associated with drilling muds and formation waters, and the resuspension of harmful pollutants in the sediments around outfalls to the food sources of the bottom-feeding fish.

d. Impact on Marine Mammals

Oil and has development on the Mid-Atlantic OCS as a result of this proposal may impact marine mammals through potential oil spills. The direct effects of oiling on marine mammals could include the matting of pelage, irritation of skin and eyes, indigestion causing internal disorders, and possible clogging or inflammation of respiratory passages. Secondary impacts may include decrease in or redistribution of food supplies.

Pinnipeds (Seals, walruses, etc.)

There are no breeding sites for pinnipeds in the Mid-Atlantic area. Only occasional strays of harbor and hooded seals have been reported in the Mid-Atlantic. The harbor seal is a coastal species, while the hooded seal is pelagic. Should oil spills occur as a result of the proposed sale, a few individuals of those species may be affected. Because of their habitat, harbor seals would be most impacted by nearshore pipeline or tanker spills (should tankers have to be used to transport OCS-produced oil). Hooded seals could be impacted by spills in offshore oil-producing areas or offshore tanker spills.

Various impacts to pinnipeds have been reported from previous spills. Dead sea lions and elephant seals were observed after the Santa Barbara spill, but there was no conclusive evidence that the spill was responsible for their deaths. Histological and pathological examina-

tions attributed the deaths to natural causes. (Brownell and LeBoeuf, 1971; LeBoeuf, 1971). Connell (1973), however, after analyzing the data of Brownell and LeBoeuf, concluded that the dead sea lion pups had more oil on their bodies than one would expect by chance.

Evidence of eye damage as a result of the oiling of pinnipeds has been shown. Nelson-Smith (1973) reported "...after the Arrow spill in Nova Scotia, young grey seals were found blundering about in woods half a mile from shore, unable to find their way back because of oil around the eyes and nostrils.... Pearce (1970) reported the rescuing of a blind female during a fuel oil spillage.

Because pinnipeds are only occasional strays to the Mid-Atlantic area, there is only a small chance that individuals would be impacted as a result of the proposed sale. Neither of the species reported sighted in the area are endangered; impact on individuals would not be expected to impact populations.

Cetaceans (Whales, dolphins, porpoises)

Thirteen species of cetaceans, including three endangered species (right, fin and humpback whales) have been sighted in recent times ( the last 50 years) in the Mid-Atlantic. There is, however, little information on the life histories of the cetaceans in the area. Lack of frequent sightings may be attributable to the absense of observers. While many cetaceans commonly travel in groups, limited data on

regional occurrences may indicate that only individuals would be impacted by oil spills as a result of the proposed sale in the Mid-Atlantic OCS.

There is little factual information on the effects of oil on cetaceans. No record is reported of cetacean deaths due to the direct effects of oil pollution. There were no reported sightings of dead whales following the Santa Barbara oil spills. Attempts to reroute grey whales which were migrating through the vicinity of the Santa Barbara spill were unsuccessful.

A potential danger to cetaceans is absorption through the mucous membrane lining the blowhole distal to the nasal plug. The blowhole remains open near the water surface and may inhale oil which could ultimately affect respiration.

As cetaceans forage for such organisms as copepods, euphausids, and fish, localized decreases or redistributions of these organisms as a result of OCS activities could limit food availability for cetaceans, but because of the large area foraged, this would not be expected to limit overall availability of food supplies for cetaceans. Ingestion of contaminated organisms as a result of an oil spill incident could occur. Chronic contributions of low levels of hydrocarbons and heavy metals as a result of OCS development is expected to be localized and not significantly alter concentrations of these substances in the Mid-Atlantic (Sections III.A. and

III.B.1) in general. Therefore, uptake by cetaceans of substances generated by routine operations would be expected on only a limited basis because of their large forage area. (Appendix 9 discusses the fate of hydrocarbons and heavy metals in the marine food web in more detail.)

Because of the endangered species status of some cetaceans, and their apparent limited distribution or occurrence in the Mid-Atlantic region, any impact to individual cetaceans could have consequences on species populations or distribution. However, there are no reported incidents of cetacean fatalities as a result of oil spill incidents. Because of the apparent paucity of cetaceans in the Mid-Atlantic, the probability of an individual being in a specific area at the time of an oil spill appears low. Therefore, while potential for impact exists, cetacean species and populations are unlikely to be impacted as a result of the proposed Mid-Atlantic sale.

### 3. Geological Hazard Impacts on Offshore Operations and Impacts of Offshore Operations on the Sea Floor

Any sedimentary province as large as the Mid-Atlantic OCS area will most likely exhibit a wide variety of geologic conditions. Several of these could pose potential hazards to offshore oil and gas operations. Many of these possible hazards involve near surface and surface phenomena which can be identified through predrilling, geophysical and geological sampling surveys (Sieck, 1975). This capability coupled with information gained from the recently completed Cooperative Offshore Stratigraphic Test (COST) well, where no shallow gas pockets, geopressures, $H_2S$, fresh water aquifers or lost circulation zones were encountered to 16,000 feet,[1] suggests that the subsurface geohazard potential in the Mid-Atlantic OCS may be minimal.

The following text discusses the several types of geohazards that may be present in the Mid-Atlantic offshore area.

Natural gas evolved from decomposition of organic materials in buried sediments, both deep and shallow, is a potential hazard for any drilling operation, though it may be encountered more often in some areas (such as the northern Gulf of Mexico) than others (North Sea). The lagoonal sediments mentioned in Section II.A. could give rise to the formation of natural gas, but none has ever been reported in the Mid-Atlantic OCS and consequently this is not regarded as a likely problem for the proposed sale. Gas pockets if they exist in shallow sediments may migrate and, if encountered by a bottom founded rig or

[1] USGS Conservation Division, Washington, D.C., personal communication, 1976.

platform, could cause the structure to lose support. In the worst case, the structure might collapse, though it might only require repair or resiting. If detected before drilling, the well would have to be resited and directionally drilled.

Geopressures caused by overpressurized liquids or gases within formations might be encountered during a drilling operation. If the drilling muds and redundant safety systems[1] were to fail in maintaining adequate downhole pressure, a blowout might occur. The blowout might result in possible loss of oil and gas or accidental deaths. Hydrogen sulfide gas is occasionally found during the drilling of deep wells and may be quite common in some producing areas (such as onshore in the Gulf Coast States). None was encountered during the drilling of the COST well, but $H_2S$ still could be associated either with oil in structures or in deep formations where anerobic bacteria have reduced organic material. If $H_2S$ warning devices fail to detect gas which has migrated up the drill stream to the mud containers, this colorless gas could cause death or paralysis to rig or platform personnel who breathe it in small quantities. Proposed OCS Order #2 which deals with $H_2S$ safety measures reduces the potential hazard to operations, however, this is a danger which is ever present or possible in the search for oil and gas.

As described in Section II.A.5., the only faults with near surface expression that have been found in the proposed leasing area appear to be inactive. However, if a rig or other bottom-founded structure

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[1]For a description of blowout preventers and other safety equipment used in drilling operations, see Appendix 9.

were to be placed over an active fault, damage to the structure, possible oil spillage, or even loss of life might occur. In a worst case, sudden displacement of a fault could shear pipelines, casing, or damage bottom supports for rigs or platforms (depending on amount of displacement). Fault creep not associated with earthquakes could possibly have the same effect, though structural weakening would be gradual rather than abrupt. Movement of natural gas along faults extending towards hydrocarbon bearing strata could weaken bottom supported structures or possibly result in major accidents to drilling rigs if not detected in advance (Sieck, 1975). Oil leaking up through faults which extend to the sea floor could result in spills. Because faults are easily located with geophysical surveys and the incidence of faulting is very low in Cenozoic sediments of the Mid-Atlantic OCS, the hazard is not expected to be a major concern for the proposed sale.

Earthquake risk is slight to moderate for this area in comparison with most operating regions (such as southern California and the Gulf of Alaska). The main factors in an earthquake are the magnitude, duration, and the interaction of the soil structure system. In the near and offshore marine environment, the following events may take place: liquefaction,[1] submarine slides, slumping, turbidity currents, and geologic structural instability. In the Mid-Atlantic OCS, earthquakes represent a remote but potential cause of an oil spill.

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[1]Liquefaction is the transformation of loosely packed sediment into a fluid mass.

Damage resulting from earthquakes could be of the following types:

(1) Failure of structures and pipelines due to seismic shaking.

(2) Shearing or bending of casing at depth.

(3) Failure of structures and pipelines due to sediment instability resulting from seismic activity.

Given the facts that the upper sediments of the Mid-Atlantic sea floor rest on lagoonal sediments (Section II.A.3.) and some buried river channels are also present in the leasing area, fluidization of fine sediments with high porosities or void spaces during an earthquake might result in damage to structures or possible oil spills during an earthquake. However, we know of no oil spills resulting from earthquake activity in any offshore operating area, including Alaska and California. Webb (DES 74-90 Accelerated OCS Leasing, written testimony) related that:

> The Tehachapi earthquake of 1952, 7.6 Richter and VII to XI Mercalli, with the epicenter in one oil field and the fault trace straddled by others, caused no pipeline failure and no spills at the many hundreds of drilling or producing wells in the area; some wells suffered bent and pinched casings, in one field. By contrast, other damage was extensive, including the explosion of a gas recycling plant (a refinery-type installation), widespread damage and collapse of buildings, road cuts, railroad tunnels, water pipes, polemounted transformers, etc. It is evident that offshore equipment designed to withstand offshore hurricanes will withstand major earthquakes.

An excellent review of soil response to seismic motion and designing offshore structures for earthquake forces can be found in Idriss et al. (1976). Tsunamis will not be generated in this proposed sale area

according to Tetra Tech (1974). Turbidity currents could only affect operations in deep water on the slope or heads of canyons.

Slope failure could occur in tracts bordering the Continental Slope though canyons are the most likely locations. In the event of this happening, pipeline could be broken, platforms destroyed, and oil spilled.

Sediment scour is a factor which must be looked into for all petroleum facilities placed on the sea floor. As mentioned in Section II.A.5., sediment migration is most active in water depths shallower than operators will encounter on the proposed lease tracts. However, storm waves could transport sediment away from rig or platform legs at these greater depths or could uncover pipelines. The potential for pipelines to be exposed by sediment transport over a period of years is high, especially in nearshore areas. Once exposed, a pipeline could rupture due to anchor dragging or trawling activities; this would result in an oil spill. Only burial and constant surveillance can present this type of accident. (Refer to Special Stipulations, Chapter IV, and Oil and Gas Operations-Appendix 4).

During the drilling operation, fresh water zones which represent offshore extensions of groundwater aquifers could be encountered. Fluid leaks between formations as a result of improper casing might contaminate the far offshore portion of the aquifer with salt water

or possibly hydrocarbons, thus removing it from use at some time in the future. As production declines, in a producing well over a number of years, the possibility exists that fresh water from a deep formation could leak into the well. The distance from shore of the proposed lease tracts, present salt water intrusion in many Coastal Plain aquifers (Section II.A.4.c.), the strong possibility of offshore facies changes, and the fact that no fresh water zones were encountered by the Mid-Atlantic COST well (Perry et al., 1974) suggest that groundwater will not be impacted by offshore drilling.

Subsidence from fluid withdrawal over the life of the proposed field Mid-Atlantic area(s) could cause localized sea floor settling and lowering. Changes in sediment compaction may affect offshore structure stability and increase stress on some pipeline sections. Since this is an easily recognizable problem and can be halted, it is not expected to be of concern to this proposed sale.

Calcareous rocks can develop solution cavities. If drill bits encounter these cavities, lost circulation of drilling fluid or even loss of drill tools can occur. No solution cavities were encountered in the COST well. For this reason and the ease with which this problem is handled in other producing areas with calcareous rocks it is not considered a hazard in this lease sale area.

A summary rating of geological hazards and their ease of mitigation is included in Section II.A.5. Discussion of USGS programs to identify hazards and proposed Operating Orders to reduce the potential for accidents or pollution is included in Chapter IV.

Although it is our opinion that concrete gravity structures will not be used as a result of this proposed sale (Section III.A.), a brief discussion of geological hazards or problems which they could encounter is included here. In the North Sea, storage tanks and some platforms have been made of concrete; the large weights (150,000-300,000 tons or more, submerged) of these structures secure them to the seafloor. Vertical and horizontal loading is so great that the bearing capacity, shear strength, and lateral variability of sediments at any selected site would have to undergo considerable investigation.

Should unforseen variations in bearing capacity (abrupt changes in sediment consolidation beneath the structure for example) occur in the sediments, differential penetration at the base of the structure may result in tilting that must be corrected (Milling, 1976). Cyclic loadings (waves) on the structure and supporting sand may cause total loss of stability through liquefaction unless the sands are quite dense (McClelland, 1975). Sliding or rocking of the base of the structure across the seafloor may also occur over time as the result of wave loadings. Earthquakes can cause liquefaction of poorly

consolidated sediments; if this occurs the structure might lose all stability.

The presence of such a large feature as a gravity platform may alter water movements along the bottom of the structure. Differential erosion at the base could cause loss of stability (tilting, rocking, sliding, or collapse) of the entire structure if not unchecked. This normally is controlled by placing mats or gravel along the sea floor.

4. Air Quality

Degradation of offshore air quality will occur in cases of oil spills, oil or gas blowouts, pipeline breaks, and as a result of the normal exhaust of the platform generators. The actual number of incidents or volumes lost cannot be predicted but would be dependent on the number of installations which will increase and then decrease over the expected 25-year development period.

The existing air mass over the Mid-Atlantic offshore region contains the pollutants generated on land which are diluted as the air mass generally moves eastward driven by the prevailing westerly winds. Any air pollutants resulting from offshore activities are subject to the same dilution effect and will be borne away from land areas by the prevailing winds.

Spilled oil begins to evaporate immediately (Section III.A.3.). Almost all of the lighter fractions which have boiling points lower than that of $C_{12}$ evaporates over the life of the spill. Evaporation introduces hydrocarbons and the volatile products of the reaction of sunlight and oil, and of microbiological degradation activities into the atmosphere. If the oil burns when released, carbon dioxide, sulfur oxides, nitrogen oxides, carbon monoxide, and other partially oxidized material will be produced. Some of these, sulfur and nitrogen oxides, can cause problems by increasing the acidity of rain in the area. Other partially oxidized materials can cause smoke or haze problems. Although the actual extent of the effects caused by the addition of these pollutants cannot be determined beforehand, air quality will deteriorate in the areas affected by the spill or the associated air mass until the fire is extinguished, the spill dispersed, and the pollutants diluted.

If natural gas is released via a blowout or pipeline break, methane, ethane, propane, hydrogen sulfide, and other toxic gases will be released to the atmosphere. The percentage of each cannot be predicted since the character of the gas is not known at present. If the gas burns when released, carbon dioxide, sulfur oxides, nitrogen oxides, and carbon monoxide are produced. Although the exact quantities introduced during the course of these accidents cannot be

predicted, the resulting pollutants will be borne away by the prevailing winds and diluted in a very large air mass.

The exhaust from the large electric generators on the platforms will contain particulates, sulfur oxides, nitrogen oxides, carbon monoxide, and hydrocarbons which would be dispersed by the prevailing winds and rapidly diluted in the Mid-Atlantic offshore air mass.

## C. Impact of Oil and Gas Operations on Man's Use of the Offshore Environment

### 1. Impact on Ports, Shipping, and Navigation

Offshore activities within the Mid-Atlantic area will have an impact upon ports, ship traffic, and navigation. See Section II.G.1.b. for a description of the major Mid-Atlantic ports. The types of affects experienced by these activities would vary depending upon the phase of OCS operations.

#### a. Ports

During the exploratory drilling phase, OCS-related water and port dependent industrial activities would be expected to locate within port areas in order to service offshore facilities. It is expected that such related activities would operate out of the Port of New York - New Jersey or the Delaware River Port. This would have a positive economic impact upon these port areas by increasing the usage of industrial land and structures which are presently vacant, underutilized, or marginally used. (However, since no statistics on capacity utilization of Mid-Atlantic ports are available, no quantification can be made.) Economic development within the ports would be facilitated by the establishment of new industry and additional business for some industries which are presently there. Locations within port areas may be temporary for very specialized activities related to one phase of OCS operations, while additional industrial or service companies may seek locations

in and around the port areas (probably the Port of New York - New Jersey and the Delaware River Port) during the latter operational phases of development and production. Due to the vast size of both the Port of New York - New Jersey and the Delaware River Port, the positive impacts discussed would be almost imperceptible. The precise magnitude of these impacts cannot be determined at this time.

It is anticipated that production from the Baltimore Canyon, as a result of the proposed sale, would replace foreign shipments of crude. Such developments would lead to a proportional decline from these sources, having a positive impact upon the balance of payments. These same developments could result in a negative economic impact in some of the port areas as the decrease in foreign shipments would affect associated business establishments, such as towing and barging services.

As far as can be determined at this time, because of the distance (approximately 200 miles) that ocean going vessels would have to travel to the nearest tract, it is expected that there will be no direct impact in the Baltimore and Hampton Roads Ports resulting from new industrial land usage or economic development directly associated

with OCS-related industrial activity. It is possible though that these ports may be affected by the dislocation of foreign crude shipments which will probably take place in the PNYNJ and the Delaware River Port.

A decline in the proportionate volume of crude from foreign sources, anticipated as a result of this sale, would cause an ensuing decrease in foreign tanker traffic in the Mid-Atlantic ports if OCS oil is brought to shore via pipeline. The precise decrease in vessel traffic cannot be determined at this time as no comprehensive count of foreign crude petroleum vessel trips has been made in the Mid-Atlantic. In addition, the amount of foreign displacement cannot be ascertained until the exact volume of production from the Baltimore Canyon (proposed lease sale #40) is known. On a national basis any decrease in tanker traffic would result in less tanker accidents and the volume of oil spilled associated with these accidents. During the oil embargo (late 1973 to 1974) when there was a pronounced decline in the volume of crude entering the nation's ports, there was also a highly significant decline in the tanker/pipeline oil spill volume ratio (5:1-1972, 3:1-1973 and 2:1-1974). The increase in the tanker/pipeline accident ratio (6:1-1972, 3:1-1973 and 4:1-1974) during the same time period may have been caused by an increase in tanker traffic due to the smaller dwt of the United States carriers. See Section III.A.2. for a discussion of tanker accidents.

More important than oil spillage associated with tanker accidents are chronic oil discharges resulting from tanker operations, unloading, bunkering, tank-cleaning, and deballasting. Less tanker traffic would lead to less water pollution in the harbors and their environs, in addition to alleviating some traffic congestion in the ports from oceanborne commerce. Although these developments have positive impacts upon the ports, their effects are not expected to produce any significant decline in water pollution. If all commercial quantities of oil and gas are transported via pipeline, there will be no OCS-related tanker traffic generated during the production phase. Although by stipulation (Section IV.E.) there will be no tankering of oil as a result of this proposal, it is possible that if only small find(s) are discovered, they could only be considered commercially producible if transported to shore in such a manner. Impacts which could result from such activities are discussed in the latter portion of this section.

b. Shipping

It is expected that during the first phase of oil and gas development, resulting from the proposal, there will be a negative impact on ship traffic which will be short term and disruptive in nature. Some conflicts may arise with vessel movements in the vicinity of major traffic areas (see following subsection on navigation) caused by the additional number of vessels performing exploratory and investigative activities. In the process of performing investigative analysis, exploratory vessels will not be travelling in the customary directions, but will be criss-crossing some areas which could cause vessel collisions.

On a short-term basis many of these impacts would still be present and disruptive during development well drilling operations. Small craft providing shuttle runs between the coast and offshore sites during normal supply replenishment activities and work crew transport would cause an increase in ship traffic in the harbors, traffic lanes, and offshore environment. Also during the development phase, there will be slow moving vessels in the vicinity during the trenching and pipe laying operations of pipeline construction. It is considered highly probable that some or all of these activities would occur in the offshore and nearshore environment between Sussex County, Delaware and Kings County, New York. Problems may be experienced that are peculiar to vessel traffic operating in and/or in close proximity to this area. Construction-related ship movements would also add to vessel traffic in the coastal environment. Pipeline construction operations, which would be disruptive in nature, would terminate once the lines are completed.

Trips by service vessels will continue throughout all phases of OCS operations. However, as exploratory and development related activities decline, associated material transport and service trips will subside. The remaining production related trips--workmen transport, supply, and service--will become more normalized. These trips are primarily directed between onshore operation bases and offshore areas of oil and gas activities. If development of onshore bases takes place as expected, within the New Jersey shoreline counties or the New York harbor area, service vessel trips would originate from these locations.

No statistics are presently available concerning the total number of vessel movements now occurring in the Mid-Atlantic OCS. Nor can an estimate presently be made on the volume of vessel traffic which could be expected as a result of this proposed sale. However, due to the magnitude of overall vessel traffic known to use the Mid-Atlantic, no significant percentage increase is expected if this proposed action takes place.

c. Navigation

As a result of the proposed sale, the major hazards to navigation would stem from the construction and installation of offshore structures on the OCS during the development and production phases. Traffic separation schemes presently exist at the entrances to both the New York Harbor and Delaware Bay to facilitate the safe passage of vessels to and from these ports (Visual No. 1). See Appendix 8 for a description of these traffic schemes. The placement of rigs and platforms on those portions of blocks that are within traffic lanes probably will not be allowed. Ships, especially foreign ships and small craft, however, do not always use these traffic lanes which increases the possibility of a collision with drilling rigs, permanent platforms, and/or vessels attending these platforms. Current Coast Guard regulations concerning lighting and fog alarms on structures are summarized in Appendix 7. The installation of rigs and platforms in the northeastern sector of the proposed area (blocks 553, 554, 596, 597, 598, 599, 641, 642, 643, 686, and 687 amounting to approximately 62,600 acres) would be most hazardous to navigation since the outbound Ambrose to Hudson Canyon traffic lane is in very close proximity to these tracts, cutting through five of them (blocks 553, 554, 598, 599, 643).

In addition, extending from these traffic lanes are heavy traffic areas which have traditionally been used by ocean-going vessels.

One of these heavy traffic areas extends out from the Cape Henlopen to Five Fathom Bank traffic lane. There are 26 lease blocks (139, 140, 141, 142, 143, 144, 183,184, 185, 186, 187, 188, 189, 190, 191, 192, 226, 227, 228, 229, 230, 231, 232, 233, 234, and 235) in the southern portion of the proposed lease area which are in direct conflict with this heavy traffic area. There are other blocks (98, 99, 100, 104, 105, 106, 270, 271, 272, 273, 274, 275, 276, 277, and 278) which are of concern because of their close proximity to this area. These 41 blocks account for 27 percent (233,420 acres) of the proposed acreage to be leased. Additional areas which are not designated traffic lanes but are heavily used by vessels are said to criss-cross the offshore area but cannot be identified at this time due to the unavailability of information.

Impacts which could result from collisions with offshore structures include loss of human life, spillage of oil, and the release of debris (parts of drilling rigs, ships, etc). The contents of a ship's cargo could pose a serious threat to the onshore and marine ecosystems if it includes toxic materials, such as crude oil, refinery products, or other chemicals.

Since there are no OCS-related offshore structures in the Mid-Atlantic, we must utilize the Gulf of Mexico experience in order to examine the incidence of vessel collisions with these structures. There were eight reported collisions between large vessels and offshore structures in

the Gulf of Mexico between July 1, 1962 and June 30, 1973. These collisions include only those vessels over 1000 gross tons. These eight accidents accounted for $87 thousand of vessel damage(only four vessels reported damage) and approximately $3.2 million in damage to platforms. No human injuries or deaths were reported. Five of these accidents occurred at night (three within two hours of midnight) and two during daylight. All of the eight major accidents occurred outside established shipping fairways and anchorage areas; only three were less than five miles from these established areas. At least five of the accidents involved foreign flag vessels.

The worst of these eight accidents occurred in 1967 when an 11,600 ton foreign flag cargo vessel collided with a platform in Ship Shoal Area Block 214 at 1:30 a.m. during heavy rain, poor visibility, 45 knot winds, and 15- to 20-foot seas. The vessel escaped with damages estimated at $12,000, but damages to the platform were on the order of $1.1 million or one-third of the total damages for all eight accidents. One year following this collision a blowout of gas and condensate occurred on this platform. There was a minimal amount of oil spilled because the well was producing gas. A summary of these vessel-platform collisions is given in Table III-28. The latitude and longitude of the platform is given when the location is known.

The remaining 22 incidents of collision between vessels of less than 1000 gross tons and platforms caused more damage to the vessels

Table III- 28. Major Collisions with Large Offshore Structures, FY 1963-1973

| Name | Type | Date/Time/Incident/Cause | Weather Conditions |
|---|---|---|---|
| GANCE (British) | Cargo | 9 Nov 63, night - Collision in Gulf of Mexico. $5,000 Damage | Overcast, visibility over 2 mi, wind 30 kt, seas 15-20 ft |
| PHILLIPS PLATFORM 115-3 | Fixed structure | $300,000 Damage Cause - Personnel Fault | |
| DAUPHIN (O.N. 254298) | Towboat | 4 May 64, day - Collision in Gulf of Mexico. | Partly cloudy, visibility over 2 mi, wind 20 kt, seas 5 ft |
| AIPLE #50 (O.N. 276123) | Cargo barge | | |
| UNKNOWN | Fixed structure | Cause - Personnel Fault $180,000 Damage | |
| GENERAL ARTIGAS (Argentine) | Cargo | 15 Dec 65, day - Collision in Gulf of Mexico. | Unknown |
| SHELL PHILLIPS FEDERAL BLOCK 135 | | Cause - Undetermined $200,000 Damage | |
| SUPERIOR 103-1 | Fixed structure | 12 Sept 67, 2130 - Collision by collision with unidentified vessel. L29°16'16.74"N 92°22'13.1"W $100,000 Damage | Unknown |
| M/S EMMA JOHANNA (German) | Cargo | 30 Oct 67, 0130 - Collision in Gulf of Mexico. L28°29'36.158"N 90°51'25.54"W $12,000 Damage | Heavy rain, poor visibility wind SE 45 kt, seas SE 15-20 ft |
| KERR McGEE OIL PLATFORM OCS | Fixed structure | Cause - Personnel Fault $1,100,000 Damage | |

Table III- 28. Continued.

| Name | Type | Date/Time/Incident/Cause | Weather Conditions |
|---|---|---|---|
| M/V OLYMPIC FLAME (Liberian) | Tankship | 10 Oct 70, 2200 - Collision in Gulf of Mexico. $60,000 Damage L28°41'17"N 91°46'20"W | Clear, visibility 5 mi, wind E 7 kt, slight sea |
| PLACID OIL CO. PLATFORM 202-1 | Fixed structure | $865,000 Damage Cause - Personnel Fault | |
| KIMON | | 4 Oct 65 - Collision in Gulf of Mexico. | Unknown |
| CONTINENTAL OIL PLATFORM D- BLOCK 47 | Fixed structure | Cause - Unknown | |
| ESSEX | Cargo | 27 Aug 69, 2340 - Collision in Gulf of Mexico. $10,000 Damage L29°06'19"N 94°23'47"W | Overcast, visibility 18 mi, wind S 5 kt (gusting), moderate sea slight swell (SE - 2 ft) |
| HUMBLE OIL OFFSHORE STRUCTURE #142-2 | Fixed structure | $500,000 Damage Cause - Personnel Fault | |

($426 thousand) than to the platforms ($102 thousand which was relatively insignificant when compared to an average cost of $20 million per installed platform equipped with production machinery). Fifteen accidents including vessels less than 100 gross tons and the remaining seven vessels were between 100 and 650 gross tons. In all cases there was no loss of life involved. A summary of these 22 collisions appears in Table III-29 .

More recently, in August 1975, there was a pre-dawn collision between a British oil tanker and an unmanned platform under construction. The collision resulted in an explosion and the loss of six lives. A six mile long, mile and a half wide oil spill also resulted.

Figure III-17 shows the increase in the number of offshore structures versus the number of accidents involving these platforms in the Gulf of Mexico. It should be noted that the number of accidents involving structures is not increasing, while the number of structures is increasing at a phenomenal rate. The accidents involving small vessels (Table III-29) might in some cases be considered self-generated; that is, the fishing vessel could have been near the rigs due to the improved fishing around the structures and the barges, cargo vessels, and passenger vessels, in some cases, could have been servicing the platforms.

In the Mid-Atlantic area, the most serious environmental hazard involving offshore structures and shipping accidents, resulting from the proposed sale, would occur in the case of an oil tanker ramming a platform. The present probability of tanker platform accidents in the area is zero, but there would be a net increase if the proposed sale is held. The precise increase in such a probability cannot be determined at this time.

Table III- 29. Collisions with Offshore Structures FY1963-1973 (Vessels less than 1000 G.T.)

| Vessel Type | Total Number | Adverse Weather | Personnel Fault | Equipment Failure | Fault of Rig | TOTAL DAMAGE (Thousands of Dollars) Vessel | Rig | Number of People |
|---|---|---|---|---|---|---|---|---|
| A. Fishing Vessel | 10 | | 5 | 1 | 4[1] | 151[5] | 24 | 1 |
| B. Barge | 2 | 1 | | 1 | | 35 | 68 | 0 |
| C. Small Cargo Vessel | 8 | 3 | 4 | | 1[2] | 221[4] | 10 | 2 |
| D. Passenger Vessel | 2 | | | 1 | 1[3] | 19 | 0 | 1 |
| Total | 22 | 4 | 9 | 3 | 6 | 426 | 102 | 4 |



Dates of Accidents

A. Feb 66
June 66
May 67
June 67
Oct 67
Nov 67
May 70
June 70
Nov 71
Dec 71

B. Dec 65
Dec 65

C. Dec 65
Dec 66
July 67
May 70
July 71
Sept 71
Sept 71
Nov 71

D. Feb 70
Feb 70

[1]Three equipment failures, 1 insufficient/improper lighting

[2]Improper Maintenance

[3]Insufficient/improper lighting

[4]Includes $130,000 to one vessel

[5]Includes $80,000 to one vessel that sunk

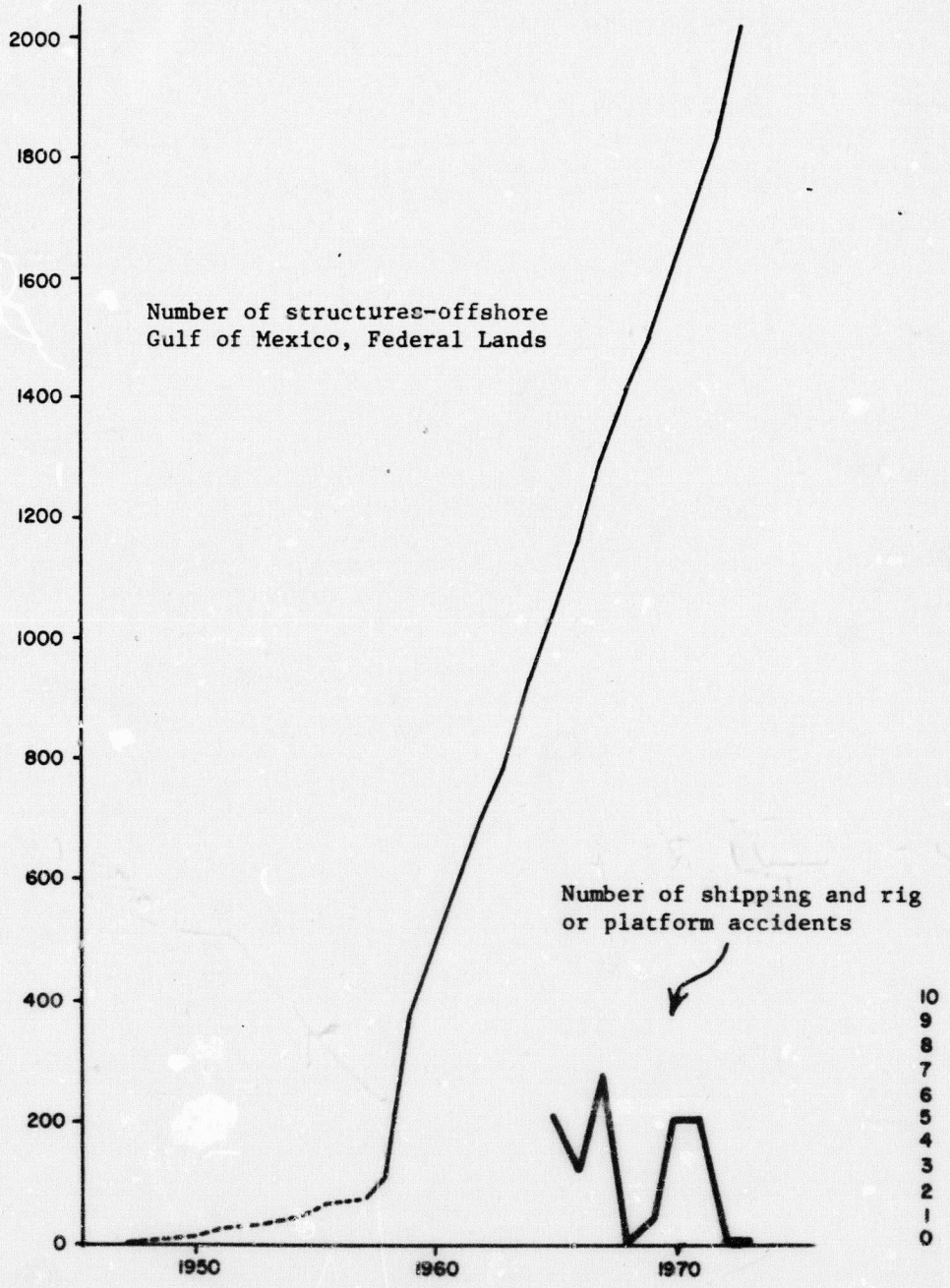


Figure III-17. Offshore Structures and Shipping Accidents Involving Rigs and Platforms (Sources: USCG, Metairie, Louisiana; USCG Merchant Safety Office, Washington, D.C.)

The drilling rigs and platforms positioned in the OCS as a result of the proposal should result in very little interference with navigation where ships utilize existing traffic lanes. At night and especially during rough weather, fog, and heavy seas, ships not navigating the traffic lanes could collide with fixed structures. If fixed structures, including subsea completion systems and temporarily shut-in wells, are located on fishing grounds, fishing boats engaged in trawling will be inconvenienced by having to detour around these structures.

Floating trash accidentally lost off platforms will also constitute a hazard to boats. Damaging collisions can result between small fast boats and floating drums, cans, and wood. The screws of all sizes of motor boats and vessels can be fouled on floating plastic sheeting and plastic or nylon ropes. The possible frequency and significance of this problem cannot be determined or alluded to.

There will be both positive and negative impacts on the area's port, shipping, and navigation activities. Present conditions preclude a determination of the level of impacts, their relative significance, and an evaluation of their net costs and benefits.

### Additional Impacts Which Would Result From Tankering of OCS-Producing Oil

If OCS-produced oil from the proposed sale has to be transported by tankers to shore, as opposed to transported via pipeline, it would still be expected to replace shipments of foreign

crude oil. The volume of crude oil would be the same, regardless of the source of the crude. However, shipment by vessel would probably result in an overall incremental increase in traffic, as smaller vessels would probably be used to transport OCS crude than are used for long haul imports to the region. A discussion of possible oil discharges or spills resulting from use of tankers may be found in Section III.A.2.

Because of channel restrictions in ports in the area, the size of vessels utilized to transport OCS-produced oil would be limited. Due to the short distance factor, vessels capable of offloading at existing refinery terminals would probably be utilized rather than tankers which would have to lighter outside of the harbor area. Vessels currently offloading crude oil at refineries in the Mid-Atlantic region range between approximately 30 thousand to 70 thousand dead weight tons (dwt), although the latter must be partially offloaded before docking at the terminals. Vessels which could be used to transport OCS crude oil would probably fall within this range, most likely at the lower end of the range. Although barrel capacities of ships vary according to a number of factors, vessels in this range could carry approximately 200 to 500 thousand barrels.

The increase in vessel movements would contribute to a somewhat greater potential for vessel accidents and vessel-platform accidents within the region.

Because the amount of tankering that might have to occur if only small finds should occur as a result of this proposal (in vessel trips and oil per vessel)cannot be determined at this time, and because no method of predicting accident ratios and volume spilled relevant to this Mid-Atlantic proposal exists (Section III.A.2), potentials for oil spills resulting from tankering cannot be quantified. However, it should be noted that new Coast Guard regulations concerning the design and operation of tankers is expected to decrease the amount of oil contributed to the ocean by these vessels by 80 percent. While the regulation concerning segregated ballasts is restricted to tankers over 70,000 dwt, sizes not expected to be utilized as a result of this sale, the regulations should nonetheless, substantially decrease the amount of oil pollution caused by vessels, thus increasing their overall performance record in terms of oil pollution. Pipelines are still considered to be a much safer transporter of oil, however.

2. Commercial and Sport Fisheries

a. Commercial Fisheries

Offshore oil and gas operations can interfere with commercial fishing activities in three general ways: removal of sea floor and pelagic areas from use, underwater obstructions, and loss of catch due to presence of oil in water and/or flesh (also refer to Section III.B.2.c.). Because there are no total (U.S. and foreign combined) catch data available for the Mid-Atlantic at the present time on a specific area basis, and the impacts on fish populations resulting from oil and gas development are largely unknown, the impacts discussed below are not quantifiable. It is not possible to indicated specifically where and what level of impacts might result in the Mid-Atlantic from the proposed action.

Removal of Sea Floor and Pelagic Areas from Use

The majority of bottom fish and some shellfish species, such as lobsters, are harvested by bottom trawls in the Mid-Atlantic area. Sites occupied by drilling or production platforms, attendant service boats, and tankers would consequently interfere with their activities. If the structures employed are jack-up drilling rigs or permanent production platforms, the area of the sea floor removed would amount to two to five acres for each structure. In deeper waters over 300 feet, a semi-submersible drilling rig with its anchoring system occupies up to 162 acres (assuming a 1500 foot anchoring radius). It is estimated that a maximum of 810 to 3240 acres could be removed

from commercial fishing temporarily at any one time, leveling off to a maximum of 250 acres (two to five acres per platform; ten to fifty platforms). These figures refer only to actual space lost. Additional fishing area may be lost due to the turning radius for various trawlers. This additional area that will be lost will vary depending upon the capabilities of individual boats. Actual acres removed, however, will probably be much less (for range of facilities anticipated, refer to Section III.A.1.). Permanent production platforms may remain in place for 10 to over 20 years.

Trawling in the Mid-Atlantic region occurs to depths beyond those of the tracts in this proposed sale (40 to 185 meters). Structures could therefore have an impact on trawling operations in the area.

Seining is primarily a shallow, nearshore fishery in the Mid-Atlantic area and platforms should present no interference. Fishermen in the Gulf of Mexico do not complain about oil platforms interfering with their seining operations as they do regarding trawl fishing; this may indicate that there is no problem involved[1].

Total number of platforms required to develop a lease area and their spacing relative to each other are important factors in considering potential impact on commercial fishing activities[2]. It is impossible, however, to determine these factors in advance of a proposed sale.

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[1]O. Allen, personal communication, 1974.

[2]See Section IV.E. for stipulation regarding placement of structures.

Offshore rigs and platforms can also present navigational problems to fishermen. Boats engaged in trawling will have to navigate around fixed structures, and there also exists the possibility of fishing boats colliding with structures. A Coast Guard summary for the Gulf of Mexico for the period July 1, 1962 through June 30, 1973, reported 10 collisions of fishing boats with offshore structures. Total damage to boats amounted to $151,000 and damage to platforms $24,000.

Commercial trawling will be adversely affected to some degree because of reduction in trawling grounds. Declines in commercial catches are generally related to fishing pressure or natural cyclic phenomena. There is currently no data to indicate that offshore exploration is responsible for any decline in catches.

Underwater Obstructions

The obstructions referred to are underwater stubs, large pieces of debris, and unburied pipelines which, when snagged, may cause damage to trawls and nets.

The source and nature of stubs are described in Appendix 4 and Sections III.A.1. and IV.E. Coast Guard regulations and OCS Order Number 3 require that stubs be marked by a lighted buoy at the surface if there is less than 85 feet of clearance. Stubs with clearance of between 85 and 200 feet must be buoyed but need not be lighted. These buoys, however are sometimes missing despite regular maintenance and replacement.

If the stub is covered by a bonnet in water depths of 85 to 200 feet, then it need not be marked by a buoy under Coast Guard regulations. However, a proposed Special Stipulation (Section IV.E.) requires that all stubs and subsea systems be marked so as to provide warning for surface vessels.

Large pieces of debris, such as equipment, piping, structural members, tools, and the like, may accidentally be lost off a platform or service barge. Losses off a platform may be located easily by divers and retrieved. However, if debris is lost off a boat or barge underway, the location may not be known accurately enough to allow its subsequent recovery. Depending on the size and weight of items lost in this way, varying amounts of damage could be done to trawling nets.

Pipeline corridors will be established, wherever possible, in the area of this proposed sale (Section IV.E.). Pipelines within the corridor will be buried to avoid accidents with trawling gear or ship anchors.

Loss of Catch Due to Oil Contamination

Various interplaying factors resulting from oil contamination can be responsible for fish distributions and populations within their habitat range. However, there are four particularly important ones:

(1) If large amounts of plankton or other assemblages fish populations are dependent upon are destroyed, the food web could be seriously disrupted and result in population declines of organisms directly or indirectly dependent upon them (Sections III.B.2.a. and 2.b.);

(2) Entire year classes of juvenile or larval fish within the contamination area might be destroyed in a given area possibly resulting in reduced yields several years after the spill (Sections III.B.2.a. and 2.c.);

(3) Oil pollution might lower organisms' resistance to disease and other environmental stresses. This could produce an increased mortality rate over a long period of time, causing a slow but marked decline in fisheries within an area that had been contaminated. Ketchum (1973) showed that abnormal development occurs following longer periods of exposure to concentrations as low as 0.01 ppm;

(4) Fish may have to be discarded due to tainting of the flesh. One example was given by Connel (1971), who stated that the Australian mullet had a kerosene-like tainting due to the presence of kerosene-like hydrocarbons in the flesh. He found the contaminated compounds to be similar to substances isolated from river sediments. Shipton et al. (1970) and Vale et al. (1970) also report on the same subject. Shipton, through gas chromatography and spectral analysis, reported the isolated kerosene appeared to be similar to a commercial

sample of kerosene. Liver examination by optical and electron microscopes revealed higher amounts of free fat than untainted samples (Vale, 1970). Sea trout and plaice were found to be tainted according to taste tests. These fish were caught after the Torrey Canyon incident involving the spillage of Kuwait crude oil. No chemical analysis by chemical class was reported (Clark, 1973).

Numerous studies on the effects of oil on commercially important shellfish indicate that these invertebrates may both absorb and, to varying degrees, clean themselves of hydrocarbons. They are discussed in Section III.B.2.b. and Appendix 9.

Oil spills can have both short- and long-term impacts on commercial fisheries. Oil spills may physically prevent fishing in contaminated areas. Adult finfish, although they may not be killed outright, may suffer a long-term decline if food webs are interrupted and resistance to disease and environmental stress is lowered. Larval and juvenile fish can also be killed in great numbers which may result in greatly reduced yields several years after the spill particularly for species which may be overfished. While many fish and shellfish may not be destroyed, they may be tainted with hydrocarbons and be unmarketable. This is very unlikely in offshore or nearshore areas, however, due to the dilution factor. Thus the various shellfisheries, such as that for the surf clam, are relatively safe from these effects. However, shellfish in enclosed systems may be more susceptible due to their filter feeding characteristics and their inability to escape.

Authors disagree on the time required for shellfish to cleanse themselves once the source of contamination is removed. Estimates vary from several months for complete depuration to no depuration after six months in clean waters. Conclusive data is lacking at this time (Section III.B.2.b. and Appendix 9).

b. Sport Fisheries

Significant amounts of sport-fishing activity do not occur in the offshore areas that have tentatively been proposed for leasing.[1] There are several possible situations when sport fishing could, nevertheless, be impacted by OCS oil and gas development associated activities. They are:

(1) The increased sport-fishing opportunities resulting from the artificial reef effect of OCS oil and gas platforms.

(2) The short-term localized diminution in fish populations caused by oil spills.

(3) The longer term diminution in fish populations due to larval kills caused by oil spills.

(4) The longer term diminution in fish populations due to larval kills caused by dredging, runoff, and/or filling of spawning areas undertaken in conjunction with the construction of OCS-associated facilities.

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[1]There is, however, some limited sport fishing activity in offshore and canyon areas for tilefish, marlin, tuna and swordfish (Section II.G.1.f.).

(5) The diminution and/or dislocation of sport-fishing participation due to oil spills.

(6) The diminution and/or dislocation of sport-fishing participation due to increased limitations on the accessibility to fishing areas caused by the construction of onshore support facilities.

These possible impacts could occur in varying combinations depending on the OCS-associated activity which is the causal factor. They are enumerated here individually so that wherever possible, causal relationships might be more specifically indicated.

Extensive testimony and evidence has been offered in the Gulf of Mexico to the effect that sport-fishing opportunities can actually be increased by fish population enhancement due to the artificial reef effect of offshore platforms. In the open sea, offshore platforms provide both food (after allowing a variable time period for succession of prey populations to develop) and cover in areas that otherwise were previously limited in these essentials. Such fish population concentrations can be expected to occur around platforms located in the proposed lease area in the Mid-Atlantic. The fish population enhancement and concentration probably will not significantly increase sport-fishing activity, however. Possible platform locations, based on the locations of tracts tentatively selected for leasing, are from 47 to over 90 statute miles from boatlaunching facilities. Assuming an average small pleasure boat

speed of 10 knots (about 12 mph), a round trip to these potential fish concentrations would be a 10- to 20-hour undertaking. Such time estimates do not even include the time required to travel to and from launching sites and for necessary preparation activities prior to launching. Consequently, fishing these areas on a day-use basis, which is the overwhelming type of sport-fishing activity undertaken in the region, is not thought practical.

These fishing areas could conceivably be used increasingly by larger and faster vessels operated individually or for charter purposes, particularly over longer periods of time. The quantity of increased sport-fishing opportunities realized by the individually operated larger vessels still would be relatively small when compared with the overall magnitude of sportfishing activity which already exists in the region as a whole. Moreover, the increased costs associated with traveling to these areas, coupled with the relative accessibility of existing areas, could discourage any significant increased use levels. In summary, although fish population concentrations will probably be increased at offshore platform locations, total sportfishing opportunities will only be increased minimally because of the great distances from shore.

Major oil spills are a potential threat to adult fish populations on a short-term localized basis. The adverse effects on different fish types (i.e., pelagic, demersal, nearshore, and estuarine),

from a biological perspective, are discussed in Section III.B.2. The impacts would be localized for the reasons discussed in that Section. Since, based on current available information, long-term toxic environments would not be maintained, fish populations could be expected to migrate back into the area once the oil slick has been removed (by wave action, containment and cleanup or dispersion). Repopulation of an area could be anticipated to be completed by the end of the succeeding spawning cycle. In most species, this would amount to a maximum repopulation period of a year. Primarily, juveniles of various species and bottom fish would be most adversely affected. Adult fish of most pelagic species would flee the spill area, thereby minimizing their mortality rates (Rice, 1973; Nelson-Smith 1972). There is insufficient data and information available, however, to be able to quantify mortality rates.

There are two types of sites at which, if a major spill were to occur, impacts on fish populations would be noticeable--fish concentrations around the offshore platforms and around other artificial fishing reefs located much closer to shore. Both situations could result in mortality among juveniles and bottom fish, as well as a dispersion of the fish population concentrations. The former sites would be impacted by blowout-associated spills or pipeline breaks near an offshore platform, whereas the latter could be affected either by a nearshore pipeline break or a nearshore spill from a barge or other crude oil transport vessel.

The platform spill would not have serious adverse impacts on sport-fishing opportunities because the platforms would not be serving as major sport-fishing areas.

The short-term impact on sport-fishing opportunities caused by a spill affecting the shoreline piers, jetties and groins, and nearshore artificial fishing reefs, however, could be serious. The loss of opportunities would be caused primarily by the dispersion of the fish population concentrations, leading to lower success rates and thereby discouraging participation. The impacts would be most serious if the artificial fishing reefs along the western end of Long Island and the northern shore of New Jersey were affected. Of the more than eight million persons who participated in saltwater fishing in the Mid-Atlantic region in 1973-1974, 34 percent fished in New Jersey and 33 percent in New York (Section II.G.1.e.). Most of this participation was generated from the New York/New Jersey Metropolitan area and focused around and near the aforementioned fishing reefs.

It is not possible to quantify, with any degree of certainty, the actual numbers of recreational fishing opportunities which could be lost because of an oil spill impacting one or more artificial fishing reef areas. The potential foreclosure of opportunities, however, is great. Generally, the impacts would be felt only for the duration of the spill and the relatively short period of time

it would take for fish to migrate back into the area and the fish population concentration to reform. This timeframe could be extended based on discouraged participation which would be attributable to a lack of fishing success experienced during and immediately following the spill.

The magnitude of the impacts would also be a factor of the time of year and size, location, and duration of a spill. For instance, bluefish, which are ranked second in popularity by numbers of participating fishermen,[1] are fished for from early summer through fall in the New York-New Jersey coastal waters with the best catch period for bluefish being late summer and early fall. Striped bass, ranked third, are fished for from spring through early winter with the best seasons occurring in early summer and fall. Consequently, if a spill occurred in early spring, striped bass fishing might be only minimally affected and bluefishing might not be impacted at all. A fall spill, however, could moderately impact, on an annual basis, both striped bass and bluefishing. A mid-winter spill might not adversely impact the annual sport-fishing activity concerned with either of these species but might still adversely affect fishing opportunities for other less popular species. Other factors affecting the magnitude of the impact are the type(s) of hydrocarbons spilled, weather cinditions and sea conditions.

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[1]See Sport Fisheries discussion in Section II.G.1.f.

In summary, short-term (less than one spawning cycle) impacts on sport fishing opportunities, localized in nature, result primarily from the dispersion of fish population concentrations and would be most influenced by the spill's seasonality and proximity to near-shore fish population concentration points.

Long-term (at least a year) impacts on sport-fishing opportunities resulting from diminution in fish populations could result from larval kills caused by oil spills. A discussion of larval kills and their effects on spawning and resultant juvenile populations is contained in Section III.B.2. From a sport-fishing perspective, fish populations during the year of the spill would decrease over a widespread area making it difficult to pinpoint a localized impact. The magnitude of the fish kill would be dependent upon the total spawning area covered by the spill, as well as the time of a spill's occurrence in the spawning cycle. The impact on sport-fishing opportunities will also be affected by the species subjected to the kill. This in turn is a factor of the location and seasonality of the spill. Populations would recover after the succeeding spawning cycle, assuming that spawning grounds do not maintain long-term toxic environments (see Section III.B.2. for a discussion of the long-term impacts on fish populations caused by sustained toxicity levels in spawning areas).

Dredging and filling activities incident to the construction of OCS-associated onshore facilities and the nearshore laying of pipelines could have both short- and long-term adverse impacts on fish populations. Larval kills could result from the turbidity associated with these activities, depending on their proximity to spawning grounds and timing within the spawning cycle (see Table II-54 on spawning times and locations for prominent species in Section II.F.1.d.) as well as from actual physical disturbance of the spawning grounds. The magnitude, location, and duration of these impacts would be similar to those discussed above. Dredging and filling for pipelines would be limited to approximately 50-foot corridors and could be undertaken in alternative locations and times of the year.

Of additional concern, however, is the dredging and filling of nearshore spawning grounds to facilitate the construction of onshore support facilities, such as operations bases. If such an event occurred, the impacts on spawning grounds would be total and permanent, but the likelihood of such a situation arising is considered minimal. The demand for new shoreside areas for the construction of operations bases will be limited because of the need for only a few sites coupled with the availability of dockage space in existing port areas. Virtually no other anticipated onshore facilities require shoreside locations and, consequently, would not necessarily raise difficulties in this regard. The extensive shoreline wetlands along the Atlantic Coast of southern

New Jersey and Delaware are important spawning areas. Consequently, the location of pipelines and the concomitant onshore support facilities in these areas potentially would have greater adverse effects on fish populations (and therefore sport-fishing opportunities) than a similar action in Monmouth County in northern New Jersey.

In summary, dredging and filling activities and increased runoff from construction onshore could have noticeable short-term impacts on larval populations but the overall impacts on sport-fishing opportunities would be negligible. The size of larval kills caused by the turbidity associated with these activities would be influenced by the size of the spawning area affected, as well as the seasonality of occurrence. Assuming there is no permanent foreclosure of spawning areas, fish populations would attain almost complete recovery by the end of the succeeding spawning cycle.

Sport-fishing participation could be curtailed and/or isolated by oil spills, particularly any major spills. Obviously, as previously discussed, diminished catches will discourage participation in localized areas. Additionally, participation would be discouraged because boat fishermen will not want to use their vessels in areas which might result in their soiling. Surf fishermen could be reluctant to fish in areas where quantities of oil have beached even if fish populations have returned to normal. For boat fishermen, a localized oil spill will primarily result in dislocation of participation. Given the mobility the boat affords,

participation can take place in alternative areas. On the average, more than three people fish from a boat for every one that fishes from a beach. Consequently, the total impact on opportunities would be minimized, but the impact that does occur would be felt much more heavily by the beach fishermen. This is particularly true in the New York-New Jersey Metropolitan area where boat ownership ratios are lower than other areas. At present there are only a limited number of shore access points where the beach fishermen can participate in the metropolitan area, and any limitation on the use of those areas would result in a quantitative curtailment, not merely dislocation, of sport-fishing opportunities for this class of fishermen. These impacts would last for the duration of the spill and whatever additional time period is required to clean up areas where oil has beached.

The use of some shoreline areas to construct onshore support facilities could disrupt sport-fishing opportunities. Primarily affected could be the shore fisherman who not only presently has insufficient shoreline areas from which to fish, particularly in the New York-New Jersey Metropolitan area, but also lacks the mobility to choose from among the alternative areas which may exist. Boat fishermen could also be impacted by the competition for already scarce docking space. Fees could be increased or marinas presently operating at mariginal profits levels could be eliminated to make way for the more profitable commercial uses. Realistically, the relative demand for new shoreside sites should not be great, and

it is unlikely, given the availability of existing areas, that there will be substantial competition for existing sport-fishing areas.

In summary, sport-fishing opportunities could be adversely impacted on a localized basis by nearshore oil spills. Dredging and filling operations could have some effects on nearshore sport-fishing opportunities.

3. Possible Conflicts with Military Uses of the Mid-Atlantic Continental Shelf

It is known that a large portion of the Mid-Atlantic Continental Shelf is used by the military (II.G.1.g.). Exercises, including air and sea gunnery, fighter and helicopter overflights, and submarine maneuvers as well as National Aeronautics and Space Administration (NASA) rocket launches from Wallops Island, Virginia, pose potential conflicts with oil and gas operations. Coordination of OCS oil and gas operations and military activities between the Departments of Defense and Interior will reduce any potential hazard of these two types of activities in the OCS.

Appropriate concerns for this proposed sale are the possibility of encountering unexploded ordnance on the sea floor, reduction in operating area for military aircraft and marine vessels due to offshore structures and support operations (crew boats, supply boats, and helicopters), and stray ammunition rounds or rocket debris striking offshore structures, vessels, or aircraft. Any accident involving ordnance or military vehicles and petroleum operations could result in oil spills, injuries, or death.

Sections IV.D. and E. discuss in more detail how these concerns will be mitigated. However, since most of the military and NASA programs take place in specifically designated areas, they should present a minimal threat to proposed oil and gas operations. The use of geophysical and other survey methods as required by the USGS Supervisor in a special stipulation designed for this potential hazard will easily pinpoint unexploded ordnance; immersion in sea water at depth after several years, however, may have defused the explosive capability of ordnance on the sea floor.

4. Ocean Dumping

Ocean dumping activities may have an effect on offshore operations and may in turn be affected by them. EPA is at present evaluating two new dumpsites as possible alternatives for the one now being used for disposal of the New York-New Jersey Metropolitan area sewage sludge. The proposed southern site lies within the boundaries of the Mid-Atlantic leasing area. If this is the site finally selected by EPA, future disposal operations would adversely affect drilling rig and platform operations. Any increase in turbidity resulting from sewage sludge disposal could interfere with the divers who perform maintenance and repair work on OCS facilities on the sea floor. Platforms, drilling rigs, and tankers (if they have to be used, Section IV.E.) would themselves create additional navigational hazards for the sludge vessels as OCS-related traffic first increases and then decreases over the period of development.

Drilling muds from exploratory wells only (approximately 691 tons, per well, Section III.A.1.) are not recycled. In this case, since discharge is not allowed without a permit under the OCS operating orders, approval for ocean disposal would have to be obtained from the USGS Supervisor (OCS Order 7). The mud could then be diluted and disposed of by those responsible for the well in an approved manner.

Onshore, increases in the population, consumer, and industrial sectors could increase the sewage sludge, construction debris, and other waste loads that are destined for disposal offshore. However, the areas that use ocean dumping as a disposal method for these wastes are not those that are indicated in the economic analysis (Section III.D.1.b.) as experiencing increases greater than one percent in these sectors as a result of the proposed action. The corresponding increases in wastes loads destined for ocean disposal would therefore be incremental.

There is a possibility of an oil spill resulting from the collision of a disposal vessel and a platform, although accidents between platforms and larger ships that have resulted in oil spill have only occurred twice in recent history.[1] The possibility of an oil spill resulting from the collision of a disposal vessel and a tanker, however, is greater since vessel-vessel accidents are more common. In actuality since the practice of ocean disposal is to be phased out by EPA before anticipated production could begin as a result of this proposal, the chances of such accidents are small.

In order to determine the effects of oil and gas development on ocean dumping activities, the various types of wastes generated offshore and onshore must be considered. Wastes generated at offshore facilities include spent drilling mud, water contaminated with oil, and the normal solid waste items, such as paper, plastic, metal and so on. All of these are collected, stored, and transported, at required intervals, to shore. The spent muds are normally reclaimed, contaminated water is treated onshore so as to meet the EPA requirements and then discharged, and the various types of solid waste materials are disposed of by locally accepted methods (incineration and/or landfilling).

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[1] U.S. Geological Survey, Conservation Division. Accidents Connected with Federal Oil and Gas Operations on the Outer Continental Shelf, July 1975.

Another aspect to be considered is that of the increased traffic levels in New York Harbor, the New Jersey shore, and Delaware Bay. The additional vessels that would supply and service the offshore facilities could lead to an increase in the number of collisions. Involving ocean disposal vessels; however, these increase cannot be determined.

While there is a remote possibility that a pipeline carrying Mid-Atlantic crude oil and gas could pass through old or new dumpsites causing the temporary resuspension of heavy metals and other toxic and non-toxic substances, this is not considered likely. Pipeline corridor studies will be conducted by BLM to determine the best routes available with the least environmental impact. This study (or studies) will allow the authorities to control the direction and placement of pipelines, and therefore, intersecting dumpsites could, and probably would, be avoided.

## 5. Offshore Archeological and Historical Sites

Offshore and nearshore sites of archeological and historical value could be impacted by a number of factors resulting from this proposed sale. Drilling rig and platform emplacement, or pipeline burial could adversely impact these sites by disturbance and destruction. Oil spills and possible coating of artifacts underwater or nearshore could depreciate their appearance and usefulness and may endanger their survival through cleaning operations; radiocarbon dating might be interfered with by contaminating the samples with crude oil. Coastal facilities developed in support of oil and gas operations could disturb or destroy nearshore sites.

Due to the distance from shore of the proposed lease sale tracts, only shipwrecks, disturbed kitchen middens, fire cracked stones, and stone implements (Paleo-Indians and Archaic Indians) could be impacted by the drilling operation alone. The scarcity of finds on land suggests that the possibility of encountering Indian remains during drilling is remote. However, a Special Stipulation (Chapter IV.) is proposed to precede any such operation with an archeological survey.

Nearshore sites of the more recent Archaic and Woodland Indians are probably more substantial in size and term of occupation than those further out on the shelf. The effects of development and production

(pipelines, coastal facilities) could disturb or destroy any previously unlocated sites. It should be pointed out that the strong movements of nearshore bottom sediment (Section II.A.5.) may have either totally destroyed these sites already or buried them. Historical sites located along the shoreline of the 17th to 19th centuries may have suffered the same fate.

Because of the sizeable petroleum industry in the Mid-Atlantic and the resulting great number of oil spills, including those of torpedoed World War II tankers, it is possible that oil may have already affected any exposed artifacts or shipwrecks in the region.

Nevertheless, avtivities and oil spills resulting from this proposed sale could adversely affect those archeological and historical artifacts which have not suffered previous damage either by natural or human causes. It is also possible that new sites and artifacts may be found that otherwise might never have been discovered; this is a positive, and likely impact. (See special stipulation in section IV.E.)

6. Impact on Future Ocean Mining

Ocean mining of sand and gravel is a major industry in many parts of the world and technology presently exists to extract these minerals from the Atlantic OCS. Interest and demand are growing, and it is expected that mining may begin on a limited scale in the near future outside of the proposed leasing area and State waters. Visual 3 depicts the location of several areas which may be potential targets (Section II.A.3.) in the Mid-Atlantic.

Although marine sand and gravel mining is not now occurring on the Mid-Atlantic OCS, oil and gas operations or accidents could possibly remove parts of the deposits from mining consideration. If a surface oil spill is weathered to the stage of tarry masses that sink, the tar could be incorporated with the upper surface of the sand and gravel deposit.[1] If a subsurface oil spill occurs (pipeline break), any number of petroleum constituents could be incorporated throughout, or only over the surface of, the sand and gravel; this depends on the location of the spill in relation to the deposit, depth of pipeline burial, size of spill, oil type, and oceanographic considerations.

The presence of oil in or on a deposit could affect mining in a number of ways. If oil is confined to the surface sediment layers, the contaminated sediment might be removed by clam shell dredge[2] so that the material below is mineable. If part or all of the deposit is polluted throughout, then that portion of the sediment could not be mineable, resulting in a loss of mineral resources and royalties to the government.

Although a pipeline route would normally be chosen to avoid potential conflicts such as this, it may be necessary to bring a pipeline through a deposit in order to reach a specific onshore

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[1]According to Clayton McAuliffe (oral testimony, public hearing, DES for proposed OCS lease sale #40, 1976) a very small fraction of crude oil from the Chevron platform fire offshore Louisiana reached the sea floor and only penetrated the upper 1½ inches of sediment.

[2]John Padan, NOAA Pacific Marine Environmental Laboratories, Seattle, Washington, personal communication, 1975.

site. In order to ensure pipeline safety, precautions should be taken. A potential might exist for accidents arising between dredging devices and the pipeline, or localized erosion from nearby mining sites causing the pipeline to be exposed. This may increase the chance of collision with trawling equipment or ship anchors. The most likely precaution measure would be to establish a buffer space around the pipeline where no mining could take place. This would alleviate both hazards described above. The result of this buffer zone would also be to cause loss of Federal revenues and mineral resources.

7. Impacts of Mid-Atlantic Weather and Physical Oceanographic Conditions on Offshore Petroleum Operations

The Mid-Atlantic OCS can be viewed as a hostile environment for petroleum operations. Under bad weather conditions, human efficiency decreases and the possibility of accidents increases. These accidents could result in injuries, loss of life, or oil spills. Under adverse situations wells are shut down, thus increasing costs and drilling time during exploration or slowing the production of oil and gas in the production phase. Poor visibility can slow or stop supply and crew vessel activities and increase the possibility of accidents between ships and offshore structures. If wave heights are too great, oil spill containment becomes impossible. Engineering loading factors from high seas can cause damage (possibly resulting in oil spills) to offshore structures as well.

Section II.B. and II.C. discuss in detail the existing information on weather and physical oceanographic conditions of the Mid-Atlantic OCS. A comparision between this and other operating regions indicates that petroleum operations have been, and are, carried out in more severe conditions than will be faced as a result of this proposed sale. Figures III-18 and III-19 show that maximum sustained winds (the average over a one-minute period of the maximum measured wind), maximum wave height, and significant wave hight (average of the largest third of all waves) are all higher in the North Sea (data from Tetra Tech, 1974) where the petroleum industry has been working since the 1960's.[1]

According to Feder (1975), North Sea wave heights are greater than 8 ft from 16-18% of the winter. In the Celtic Sea, daily maximum wave heights exceed 10 ft 40% of the year and 20 ft for 5% of the year (Oil and Gas journal, 1975). On the Canadian Shelf offshore Vanconver Island, Sexton (oral testimony, public hearing, DES for proposed OCS lease sale #40, 1976) reports a SEDCO semi-submersible recorded sustained winds of 75 mph gusting to 100 mph accompanied by a 95 ft wave in a severe storm. Hurricanes passing through the Gulf of Mexico, such as Camille, have generated winds of 125 mph and 72 ft waves (Patterson, 1976).

Water currents as much as 9 knots are faced daily by operators in Cook Inlet, Alaska, so the much lower speed water movements in the Mid-Atlantic should be no problem. With regard to operations downtime, Kennedy (1974)

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[1]The Tetra Tech Study was conducted for CEQ; the findings indicate that conditions in the South Atlantic and Central Atlantic (Maryland/Virginia border south to Cape Hatterns) are more severe than the North Sea and this proposed Mid-Atlantic lease sale area.

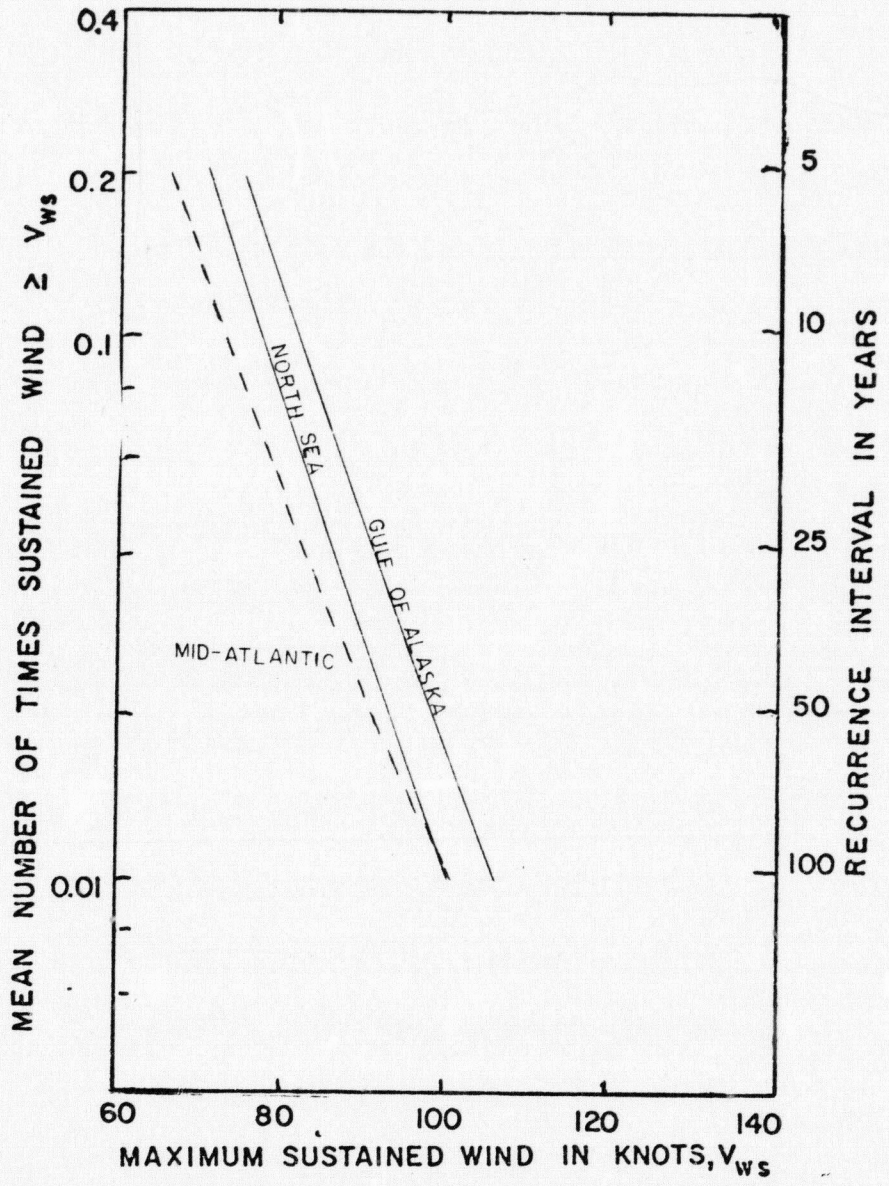


Figure III-18. Comparison of Maximum Sustained Winds for the North Sea, Gulf of Alaska, and Mid-Atlantic (Modified from Tetra Tech, 1974)

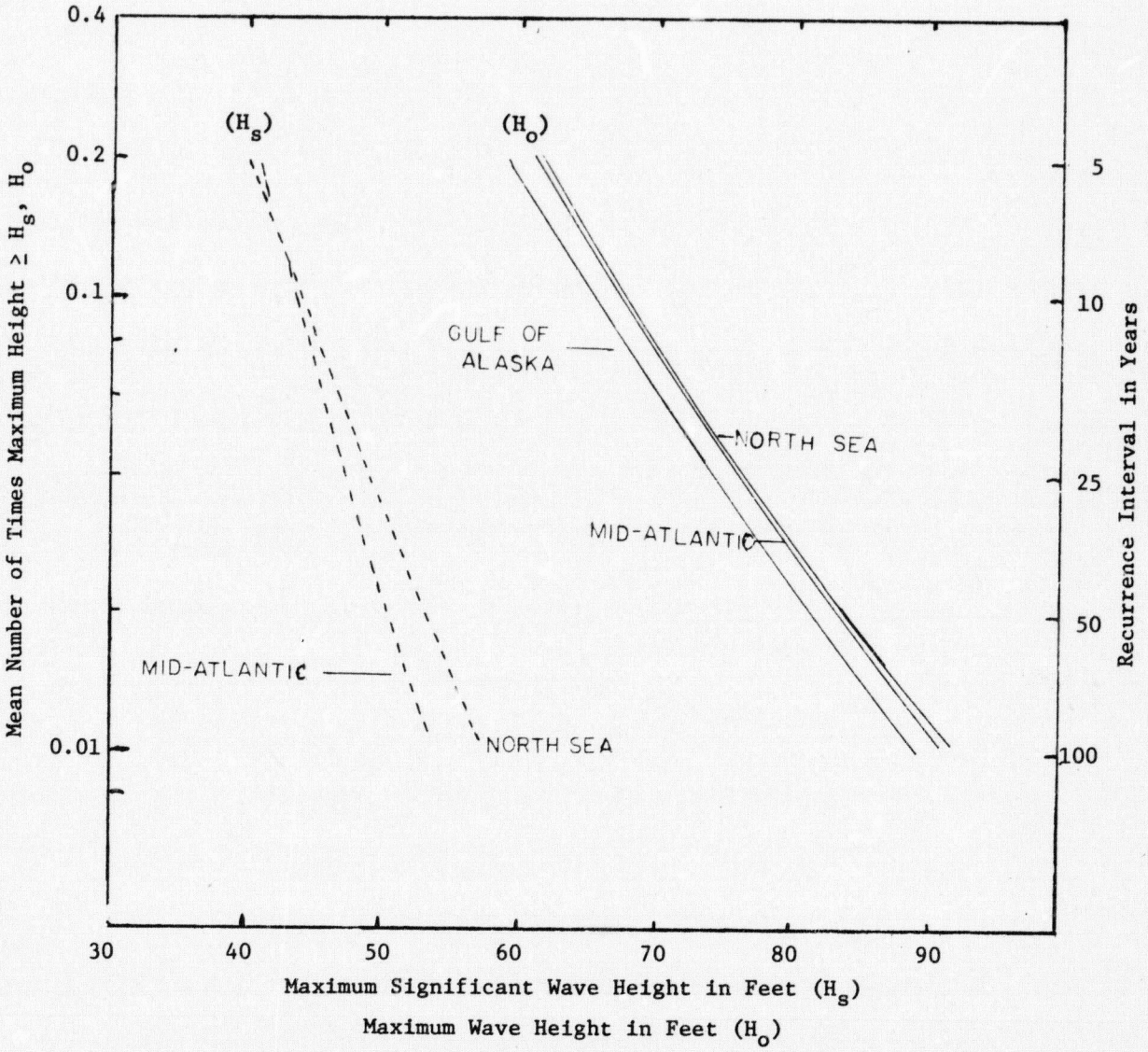


Figure III-19. Comparison of Storm Waves of the North Sea, Gulf of Alaska, and Mid-Atlantic Offshore New Jersey and Delaware
(From Tetra Tech, 1974)

found North Sea averages of 15% of the year for drilling and 25% for supplying activities. Sexton (oral testimony, public hearing, DES for proposed OCS lease sale #40, 1976) stated that jack-up rigs can operate with wind speed limitations of approximately 60 mph, drillships with wind speeds of 30 mph and wave heights of 12 ft, and semi-submersibles with winds of 50 mph and 35 ft waves.

Figures II-28a through II-28c illustrate the expected frequency for the Mid-Atlantic of waves greater than 5 and 12 feet. During the winter (and worst operating) months, the median significant wave height is 4 feet; the frequency of waves higher than 12 feet is 5 percent or less. We anticipate that periods when operations will be suspended due to high seas will be much less often than they occur in the North Sea[1]. On the other hand if an oil spill were to occur, containment devices would approach their least favorable operating conditions between less than 10 percent and 30 percent (winter) of the year. It should be noted that according to oil spill trajectory models (Section III.A.4.) spills are more likely to come towards shore in spring or summer (a period of lower wave heights, with easier containment possible) than winter (when higher seas will aid in dispersing slicks).

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[1]According to the USGS (Conservation Division, Washington, D.C., personal communication, 1976), operations were safely conducted on the COST well drilled offshore New Jersey from December, 1975, to March, 1976. Operations were suspended for a total of 24 hours during that period due to weather.

As a part of the BLM environmental studies program, Goldsmith (1976) prepared a wave model for the OCS in the vicinity of the proposed leasing area. According to the model, part of the northwesterly group of tracts could experience wave energy concentrations when waves come from the northeast with a period of 12 seconds, and lesser concentrations during northeasterly, easterly, and southeasterly waves having periods of 10, 12, and 12 seconds, respectively. He also found that the southwest portion of the lease blocks could have wave energy concentrations for NE, E, and SE waves with 12 second periods. Since this model is yet unsubstantiated in the lease areas by direct observation, Goldsmith states that definitive conclusions will require more exhaustive treatment of data, and that the analyses are regional and not site-specific. Some areas of concern are shown in Figure III-20 where wave fronts (straight or curved lines) have been refracted to form "caustics" (where several wave fronts cross).

Chao (1971) and Chao and Pierson (1970) found that wave fronts, after escaping from caustic regions, continue to follow original paths and conditions as if no caustic had occurred. This means that only at the "caustic" are waves higher. An examination of Figure II-27 shows that waves coming from the northeast, east, and southeast with periods greater than 9 seconds occur less than 5% of the year. For these reasons, refraction is not considered to be a significant problem from any given tracts.

Visibility reduction due to fog is faced regularly by operators in the Gulf of Mexico and the North Sea. These conditions may briefly limit supply of crew activities by helicopter, and slow down boat movements in lieu of helicopters,

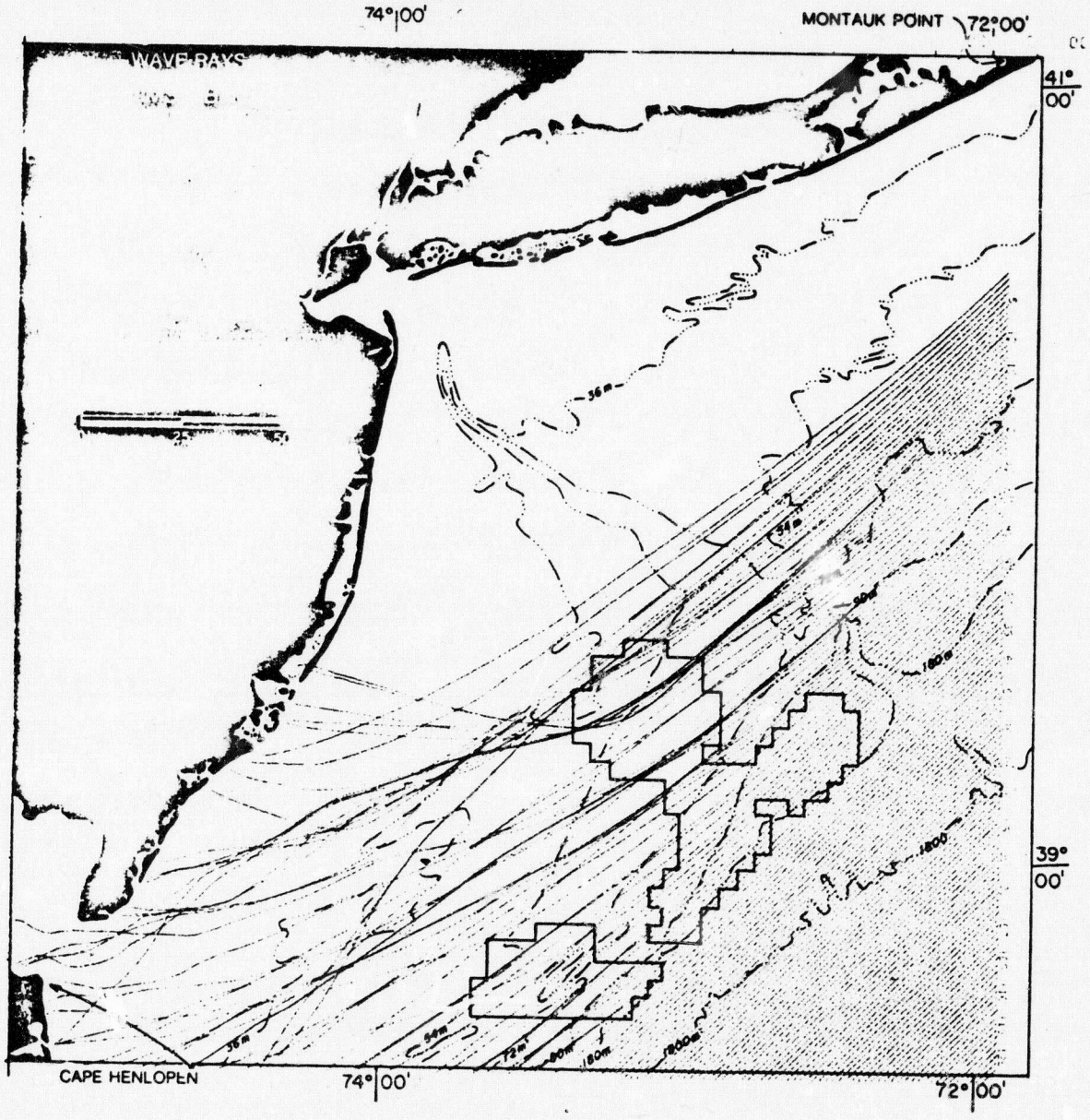


Figure III-20. Locations of Wave Caustics. Wave refraction diagram, 6 ft waves coming from the NE with a period of 12 seconds. Wave fronts are shown as straight or curved lines, caustics occur where several fronts cross, clear areas experience lowered wave heights. (From Glodsmith, 1976).

but they should not interfere with day-to-day drilling or production procedures. However, due to high use of the Mid-Atlantic OCS by shipping and fishing interests, collisions between vessels and rigs or platforms could occur, resulting in damage, injuries, death, and possible oil spills (Section III.C.1). In a favorable impact, platforms could provide safe refuge for vessels in poor visibility conditions. According to data shown in Table II-9 , visibility is reduced to less than 2 nautical miles on the average of 5% per year in the proposed leasing area.

Winter temperatures and wind chill factors are not as severe in the Mid-Atlantic OCS as those faced in Alaska, the North Sea, or Celtic Sea. Industry workers could have some difficulties in cold weather, however, operations have taken place successfully in similar or colder environments. Sea ice is not expected to be a problem (Section II.C.6.).

In summary, the Mid-Atlantic OCS will not be as difficult to work in as other locations faced previously by the petroleum industry. However, certain harsh conditions can result in accidents, loss of life, or spilled oil. Perhaps the greatest problem which may be faced is the potential for collisions of fixed structures with tankers (if they have to be used for this proposed sale) or other vessels being struck by other vessels during storms or poor visibility conditions. High seas can slow or shut down well operations, stop supply, and pipeline laying activities temporarily and result in higher production costs. Delays for that reason could delay oil production.

## D. Onshore Impact of Oil and Gas Operations

### 1. Impact on Man's Use of the Environment

#### a. Introduction

This section will discuss the estimated range of facilities and employment anticipated to result from this proposal. The discussion will include those estimates based on the Geological Survey information relative to estimated recoverable resources of the 154 tracts of 0.4 to 1.4 billion barrels of oil and 2.6 to 9.4 trillion cubic feet of gas, and on the high discovery rate of 2.6 billion barrels of oil and 12.8 trillion cubic feet of gas. Section III.A. contains an explanation of these resource estimates.

Subsequent sections will discuss the possible onshore impacts of these OCS-related facilities and activities, as well as analyze induced activities and their effects on the human and natural environment. Since the impact of a given facility or activity, including its induced effects, is a function of where it is located, an attempt will be made to indicate what factors would determine the types and levels of impacts which could be expected in different types of localities. Because it is not possible to indicate with any certainty the future locations of facilities which may result from this proposal, a generic approach has been taken for purposes of this analysis.

In order to provide a framework for subsequent subsections, this section will briefly discuss the nature of OCS-related facilities. Factors affecting the timing and distribution will be addressed.

In addition, these factors will be applied to indicate general locations thought to be most likely to be affected by OCS development.

Range of Facilities

Listed below (Table III-30) is the estimated range of major facilities anticipated to be required as a result of the proposed sale, as set forth in Section I.D.

Table III-30. Estimated Range of Major Facilities Anticipated to be Required as a Result of Proposed OCS Sale #40

| | |
|---|---|
| Rigs (Maximum working at one time) | |
| --exploratory | 5 - 20 |
| --development | 5 - 20 |
| Platforms | 10 - 50 |
| Terminal/Storage Facilities | 1 - 4 |
| Onshore Operations Base | 1 - 4 |
| Gas Processing Plants (Units with capacities of 300-500 mmcf/d) | 3 - 8 |

Refineries

Refineries have not been included as facilities necessitated or stimulated by this proposed sale.

The future demand for domestic refining capacity in the Mid-Atlantic region cannot be determined with any certainty. There are indications of excess refining capacity nationwide. According to Business Week, January 12, 1976, the two-year decline in demand, coupled with market conditions and high prices, has left U.S. refiners considering how existing capacity should be utilized, rather than planning for expansions. Existing capacity has been increasing at an average rate of 7 percent in recent years, according to the article. However, most

increases were achieved through expansions or improvements of existing facilities. For example, the Oil and Gas Journal, in its annual refining survey (April 1974), indicated a 6.3 percent capacity gain in 1973. Practically every case, it reported, was due solely or in large part, to debottlenecking.

Within the Mid-Atlantic region, Mobil cancelled its plans for a new refinery at Paulsboro, New Jersey. The major reasons cited were inflation and a decrease in demand (Oil and Gas Journal, January 11, 1974). Amerada Hess closed down its 65,000 barrel/day refinery at Port Reading, New Jersey, in November 1974. The refinery could be brought back on stream within about a month if conditions warranted, according to the company (Oil and Gas Journal, October 28, 1974).

Refinery capacity in the Mid-Atlantic coastal area as of January 1976 was 1,427,800 barrels per calendar day. Planned expansion to these refineries are expected to add another 110,000 barrels per day by the end of 1976. In addition, new proposed refineries in the Baltimore, Maryland, and Hampton Roads, Virginia, area could add an additional 384,100 barrels per day capacity.[1]

Approximately 85 percent of the crude oil refined in Petroleum Administration District I, which is made up largely of these refineries, comes from foreign sources.

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[1] Oil and Gas Journal, April 26, 1976.

Thus even under the high discovery estimates, 740,000 barrels/day oil produced as a result of the proposed action could be adequately handled by existing refinery capacity.

There is no reason to believe that an increase in regional production of oil would result in an increase in demand regionally. Changes in refinery capacity will be the result of changes in demand for products and other market factors. Whatever regional demand for refined products that will exist in the future will be met by a combination of products imported by the region from foreign and extraregional sources, and locally refined products. To the extent that domestic crude is unavailable to regional refineries, imports would have to be utilized. Thus, while any production from the Baltimore Canyon would not necessarily result in a barrel for barrel replacement of existing foreign imports, it could be expected to replace imports which would otherwise be required.

Further discussion of the relationship of OCS development and refinery capacity and locations may be found in the Final Environmental Impact Statement on Proposed Increase in Oil and Gas Leasing on the Outer Continental Shelf, Volume 2, pp. 194-204.

Should a future regional demand for refined products trigger the need for a 200,000 barrel per day grassroots refinery, 650 acres for all refinery facilities and storage tanks would be required. However, 1200 acres is generally regarded as the minimum overall land requirement for a new refinery site. This acreage would allow space for expansion and buffer.

It is estimated that a new refinery operating in 1985 would require about 500 employees. Increases in productivity and improved technology, however, could decrease the number of workers required. Most employment requirements are for skilled labor. The extent to which available local labor could or would be utilized in a new refinery would depend on the skills and nature of the existing labor force and the extent to which training would be provided for local labor. The initial construction of a new refinery would also require considerable labor.

Electric power requirements for refineries are estimated at 630,000 KWH/day per 100,000 bbl of oil refined (CEQ, RPA analysis). Newly built refineries are expected to shift toward closed water systems and air-cooling systems to reduce water requirements. This shift would result in a requirement of 4 million gal/day in the year 2000 (CEQ, RPA analysis). Most air and water pollution loadings are not expected to present major problems for any future refineries that might be built within the region because of the utilization of improved technologies for pollution control and treatment. An exception is hydrocarbon emission, which would probably continue to pose significant control problems. Increased hydrocarbon emission could also stem from induced industrial activity in new or existing industries such as the petrochemical industry. If any new refineries should be located in areas where there are existing refineries, problems stemming from increased hydrocarbon emission and emission increases due to population changes would occur in areas where the assimilative capacity of the environment is already being strained. (Type I and II areas as described in Section II.G.2.).

Some of these same affects would also be produced as a result of expansions of existing refineries. Potential increases in air pollution would be of special concern, because of the existing air pollution problems in the existing refining areas. However, it is not possible to predict the impact to air quality as a result any such expansions. Debottlenecking or retrofitting technologies (through which most recent capacity increases have occurred) could result in stable or decreased pollution loadings. In addition, any expansion plans would require permits and would have to comply with prevailing EPA emission standards.

Any decision to invest in a new refinery in the Mid-Atlantic coastal region would have widespread economic effects through successive rounds of additional spending. Increased income and employment opportunities would result from such an investment. Increased infrastructure might have to be added to support possible increases in population within the area. This would be more likely in areas with low population density (Type III and IV areas as described in Section II.G.2). To the extent that refinery investment stimulates growth in new and existing industries within the region, economic activity could be expected to increase.

For example, CEQ-RPA examined refinery development in Cumberland and Cape May Counties in New Jersey. The impact of 0.35 to 0.5 million barrels/day refining capacity in 1985 and 2000, respectively, was studied. Comparing the predicted impact of these cases with predicted

base case, employment was indicated to rise 20 to 30 percent and economic output 56 percent. In more industrialized localities, such large induced effects would not be expected. The CEQ-RPA study also indicated that, on a regional basis, the impact of this level of refinery development would not be great. For the Delaware River Basin, net employment and economic output was predicted to increase 2 percent and 4 percent, respectively.

Factors Associated with OCS-Related Facilities and Generalized Potential Locations

Table III-31 lists primary OCS-related facilities, indicated previously, plus additional, smaller facilities, and approximate employment and investments associated with each.

The timing of investments in OCS-related facilities, and resulting employment levels occurring as a result of the proposed sale, depend on the success of initial operations. As previously indicated, exploratory drilling is expected to commence within one year of the proposed sale date and could continue for 10 to 15 years.[1] The peak exploratory activity would occur in the initial five years of a lease. Existing port facilities are expected to be utilized in the early years, as staging and supply bases, to support these activities.

As they are the closest to the proposed leasing area, the Ports of New York/New Jersey, Philadelphia or Atlantic City, New Jersey, would probably be used. Atlantic City was the base of operations for the

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[1] See Section III.A.1.a.

Table III-31. Employment and Investment Costs of OCS - Related Facilities

| Facility | Employees Per Facility[1] | Expected to be hired from within the region[1] | Total Wages $/year[1] | Costs or Investments[2] | Comments |
|---|---|---|---|---|---|
| **Exploratory Rig** | | 42 (26 expected to commute from outside of the region) | 1,500,900 | Exploratory well drilling cost: $3,000,000/well | Rig crew consists of pusher, driller, derrickman, motorman, etc. Also includes catering. Service support includes mudman, cementing, logging, etc. Air personnnel are pilots and mechanics; marine personnel are standby and supply boat crews. |
| Contract Rig Crew | 72(7/7) | | | | |
| Dockside Support | 6(5/2) | | | | |
| Service Support | 11(7/7) | | | | |
| Co. Supervision | 4(7/7) | | | | |
| Transportation | | | | | |
| Air | 4(7/7) | | | | |
| Marine | 16(7/7) | | | | |
| | 113 | | | | |
| **Development Rig** | | 28 | 921,000 | Development well drilling cost: $1,200,000/well | Rig crews similar to those of exploratory rigs, although smaller. service support same as for exploratory rigs, but includes directional drilling and completion personnel. |
| Contract Rig Crew | 52(7/7) | | | | |
| Dockside Support | 2(5/2) | | | | |
| Service Support | 8(7/7) | | | | |
| Co. Supervision | 3(7/7) | | | | |
| | 65 | | | | |
| **Platform Production Operations** | | 15 | 229,000 | $20,000,000 Platform production equipment with installation | Remedial crew includes workover, wireline and service technician personnel. |
| Co. Employees | | | | | |
| Pumper-Operator | 2(7/7) | | | | |
| Mechanic | 1(7/7) | | | | |
| Electrician | 1(7/7) | | | | |
| Technician | 1(7/7) | | | | |
| Roustabout | 3(7/7) | | | | |
| Supervisor | 1(7/7) | | | | |
| Contract Employees | | | | | |
| Welder & Helper | 1(7/7) | | | | |
| Paint Crew | 1(7/7) | | | | |
| Roustabout | 2(7/7) | | | | |
| Remedial Crew | 2(7/7) | | | | |
| Caterers | 1(7/7) | | | | |
| | 16 | | | | |

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Table III-31. Continued.

| Facility | Employees Per Facility | Expected to be hired from within the region | Total Wages $/year | Costs or investments | Comments |
|---|---|---|---|---|---|
| Onshore Operations Base[3] | | 111 | 1,598,100 | $2,800,000 capital investment $470,000 for pollution containment and pick up equipment located at each base (in addition to above, $150,000 for each fast response pollution containment and pick up unit maintained in the region) | Air personnel are pilots and mechanics. Marine personnel are boat crews. Assume 3 large helicopters, 4 crew boats, 3 cargo boats and 2 tug boats Company personnel are of an administrative type. |
| Co. Employees | 8(5/2) | | | | |
| Contract Employees | | | | | |
| Air | 27(5/2) | | | | |
| Marine | 76(7/7) | | | | |
| Service Support | 25 | | | | |
| | 136 | | | | |
| Onshore Office | | 16 | 729,600 | | |
| Co. Employees | | | | | |
| Supervision | 8(5/2) | | | | |
| Technical | 18(5/2) | | | | |
| Clerical | 16(5/2) | | | | |
| | 42 | | | | |
| Pipeline | | | | | |
| Shore Terminal | | 13 | 242,400 | $4,000,000 for unit able to handle 200,000 bbl/d in addition, cost of laying 36" pipeline: $1,000,000/mile offshore $300,000/mile onshore | |
| Co. Employees | | | | | |
| Supervision | 1(5/2) | | | | |
| Gauger | 4(7/7) | | | | |
| Roustabout | 6(7/7) | | | | |
| Technician | 2(7/7) | | | | |
| Dispatcher-Clerk | 4(7/7) | | | | |
| | 17 | | | | |
| Gas Processing Plants (300 mmcf/d to 500 mmcf/d units) | 28-48(5/2) | 17-30 | 378,000-648,000 | $24,000,000-$500,000,000 capital investment | |
| Service Support | | | | | |
| Mud Supplier | | 10 | 353,400 | $900,000 capital investment | |
| Office Employees | 7(5/2) | | | | |
| Marine Employees | 16(7/7) | | | | |

Table III-31. Continued.

| Facility | Employees Per Facility | Expected to be hired from within the region | Total Wages $/year | Costs or investments |
|---|---|---|---|---|
| Service Support Continued | | | | |
| Wireline Company Base Employees | 15(5/2) | 7 | 198,000 | $ 1,200,000 capital investment |
| Gas Lift Company Employees | 5(5/2) | 3 | 72,000 | $50,000 capital investment |
| Logging and Perforating Co. Base Employees | 10(5/2) | 5 | 144,000 | $300,000 capital investment |
| Welding Shop Welders & Helpers | 20(5/2) | 23 | 261,600 | $75,000 capital investment |
| Clerical | 3(5/2) | | | |
| Rental Tool Co. Employees | 10(5/2) | 5 | 174,000 | $400,000 capital investment |
| Fishing Tool Co. Employees | 9(5/2) | 4 | 151,200 | $200,000 capital investment |
| Wellhead Equipment Co. Employees | 12(5/2) | 4 | 201,600 | $200,000 capital investment |
| Machine Shop Employees | 9(5/2) | 9 | 145,800 | $275,000 capital investment |
| Trucking Firm Employees | 15(5/2) | 15 | 162,000 | $255,000 capital investment |
| Cementing Co. Employees | 12(5/2) | 5 | 158,400 | $950,000 capital investment |
| Supply Store Employees | 9(5/2) | 5 | 108,000 | $110,000 capital investment |
| Downhole Equipment Co. Employees | 11(5/2) | 4 | 165,000 | $130,000 capital investment |
| Diving Service Employees | 11(5/2) | 9 | 250,800 | $150,000 capital investment |

[1]Derived from information provided by Offshore Operators Committee, an industry association, except that some information regarding gas processing plants is based on information from Resource Planning Associate and reported in CEQ's Oil and Gas--An Environmental Assessment. Wage figures reflect 1974 wages in the Gulf of Mexico.

[2]Based on information provided by Offshore Operators Committee and the U.S. Geological Survey. Not listed, but to be expected over time are royalty costs, costs for transportation, well servicing, equipment maintenance, overhead, total labor costs and miscellaneous.

[3]Assumes cooperative ventures between lessees. If this does not occur, several smaller bases would be required. A base this size could support production at level of up to 200,000 bbl/d.

recent COST well drilled in the Baltimore Canyon. If early results indicate commercial quantities of oil and gas, development well drilling could begin as early as 1979 and investments in grassroots facilities would be made. Many of the onshore facilities are constructed to service drilling operations and include lessees' operations bases and service support companies.

While specific site locational constraints of onshore operations bases, from which rigs and platforms are supplied and serviced, are straightforward, it is not known what the specific transportation and other costs would be. Minimizing the cost of shipping goods and services to where they are needed will be a factor in locating the operations bases. Therefore, the distance between the bases and the operating area (proposed sale area) must be considered. Minimizing transportation cost of obtaining goods and services would also be a factor, so that access to larger metropolitan areas would be a consideration. While other costs (costs of labor, land acquisition, and possibly those stemming from conditions placed upon a project proposer in meeting regulatory standards) could outweight transportation costs, the latter are considered more important. Because of this it is believed that operations bases are most likely to be located in the New York harbor area, along the New Jersey or Delaware Atlantic shoreline or the lower Delaware Bay. There are no suitable anchorage sites along the nearby Maryland shorefront. Specific site requirements of these facilities will be discussed in more detail in Section III.D.1.d.

Table III-32 indicates industry estimates of expected types of service support facilities which could be required in addition to operations bases. The amount of activity necessary to establish each in the region is also indicated.

The remainder of the onshore facilities which could result from the proposal, gas processing plants and terminal and storage facilities, are constructed to service production operations and are geared to peak levels.

Terminal facilities would be located near the landfall of pipelines, and the oil pipelines would then proceed to refineries for processing of the crude oil. Because it is expected that the oil will be processed in existing refineries in the northern New Jersey or the Delaware River Basin, it is most probable that pipeline terminals would be located somewhere along the New Jersey coast, with pipeline routes over land to the refineries. Because of the expense of laying, monitoring and maintaining underwater pipelines, landfalls near or on the Atlantic shoreline of New Jersey are more probable than those deeper into Delaware Bay. However, a pipeline landfall in Delaware, with a corridor through Delaware City and/or Philadelphia area refineries has also been suggested (Goodman, 1975 et al.). A pipeline landfall in Delaware could conceivably mark the beginning of a corridor to Baltimore, although the small existing capacity there is not thought to warrant it. However, a new 200,000 bbl/d refinery (Crown Petroleum) has been proposed for the Baltimore area. Even with increased refinery capacity in the Hampton Roads area of Virginia (expansion plans of the Amoco Refinery in Yorktown, and the developmental plans proposed by the

Table III-32 . Industry Estimates[1] of Onshore Facility Requirements for OCS Oil and Gas Operations in the Baltimore Canyon

| Stimulus | Number Possibly Required for Full Development of Region | Company Type |
|---|---|---|
| minimum of 10-20 rigs working to establish facility.<br><br>10-20 rigs could attract 2 to 3 facilities | 5 | Mud Suppliers[2]<br>Wireline Company<br>Gas Lift Company<br>Logging and Perforating Company<br>Cement Company<br>Supply Store |
| minimum of 10-20 rigs working to establish facility | up to 10 | Welding Shops<br>Machine Shops<br>Fishing Tool Company<br>Rental Tool Company |
| minimum of 10-20 rigs working to establish facility | 3-5 | Wellhead Equipment Supplier |
| minimum of 10-20 rigs working to eatablish facility | 6 | Downhole Equipment Companies |
| minimum of 10-20 rigs working to establish facility | 5 in addition to existing facilities | Machine Shop |
| minimum of 10-20 rigs working to establish facility | 2 in addition to existing facilities | Trucking Firm |
| minimum of 10-20 rigs working to establish facility | Not more than 1 | Diving Service |

[1] Offshore Operators Committee, an industry association.

[2] A mud supplier was established in Florida subsequent to the MAFLA Sale No. 32, where seven rigs were working.

Hampton Roads Energy Company for a 175,000 bbl /day capacity new refinery), the cost of marine pipeline is thought to prohibit pipelines to that more distant location, given alternatives available. In the unlikely case that tankers have to be utilized to transport any crude oil produced as a result of the proposal, shipment to Hampton Roads refineries could be a feasible alternative to northerly existing refineries.

The location of gas processing plants will also be influenced by marine pipeline routes. Therefore, gas processing plants could be located near oil pipeline terminals, if gas pipelines share corridors with oil pipelines. To reduce transportation costs, especially in light of the greater cost of marine pipelines as compared to onland pipelines, the shortest marine routes for all pipelines with the least environmental impacts would be sought. However, constraints such as bottom conditions (offshore) and appropriate landfalls must also be taken into consideration. (Offshore pipelaying is discussed in Section III.A., and pipeline approval procedures are discussed in Section IV.D.). Therefore, it is most likely that gas processing plants would be located in New Jersey, although they might also be located in Delaware and Maryland (Eastern Shore). However, there is no need for coastal locations for processing plants, thus they could be located considerably inland of the terminals. Again, it is most likely that these plants would be in New Jersey, although Delaware and Maryland (Eastern Shore) might also receive such plants. In addition, pipelines from gas processing plants to existing transmission lines (Visual No. 1) will be required.

Because of the overlap of operations stages, direct employment associated with onshore facilities and offshore operations (listed in Table III-31) would peak in the early to mid-1980's at levels estimated at between 900 and 3600 employees. The majority of construction activity onshore would be completed by 1990 when peak production levels are reached. Employment could then gradually level off to between 400 and upwards of 2000 to support production operations (including transportation of oil and gas processing).

Platform Fabrication

Platforms must be constructed for the development and production phase. The U.S. now has platform fabricating yards in Louisiana, Texas, and California. Platforms have been constructed in these yards and transported to many other offshore areas including the North Sea. Platforms for the Mid-Atlantic could be constructed in these existing yards. If additional capacity is needed, or other market conditions warrant it, existing yards could be expanded or new yards might be built nearer to production areas. Since traditional shipyards are usually not suitable for platform fabrication, a new site would probably be needed for construction in the frontier area.

The President of J. Ray McDermott and Co., a major fabricating company in Louisiana, presented testimony at the Council on Environmental Quality hearings concerning platform construction for the Atlantic OCS. He indicated that in the early stages of development, platforms would probably be supplied from fabricating yards in the Gulf of Mexico area.

However, Brown & Root, another major platform fabricator, has taken a different approach. It has already purchased a 2000 acre site for a fabrication facility in Cape Charles, Virginia, which is on the Delmarva peninsula and near the major shipbuilding area around Norfolk. Since the site is in a county with no industrial zoning, the construction of the facility is contingent upon a favorable zoning ruling. To date no final decision has been reached. If the facility is constructed, platforms could be constructed for the Atlantic OCS as well as other offshore areas, depending on where platforms are needed when the company is ready to seek contracts. Since other items can be produced from such a facility, including light metal tanks, metal storage bins, LNG tanks, and structural modules, its economic viability would not necessarily be dependent upon platform fabrication for OCS use.

While the proposed action, a first sale in the Mid-Atlantic, provides incentive for platform fabrication on the Atlantic Coast, it is not felt that platform fabrication yards on the Atlantic coast would be a direct result of this proposed sale. They would be the result of overall demand for platforms, existing capacities for platform construction, competitive positions of individual companies, and the overall program to accelerate OCS leasing, particularly the initiation of action concerning proposed sales off the Atlantic coast. (This aspect of the accelerated leasing program is addressed in the Final Environmental Statement on the Proposed Increase in Oil and Gas Leasing on the Outer Continental Shelf).

There are indications that platform fabrication facilities may not be located further north than the Virginia area. This is due to the higher cost of labor and land along the more northerly sections of the coast, and the fact that immediate proximity to a leasing area is not required.

Construction of concrete platforms, not considered likely as a result of this sale, is more closely linked to areas of production. Concrete platform construction, and use of concrete platforms are discussed in Appendix 4 and Section III.A.

Should such a platform fabrication facility be located on the Atlantic coast, onshore needs would include dock space to land crew and supply boats. A temporary office trailer would be sufficient for conducting administrative matters. Such a yard would probably be located on an inland waterway that has unobstructed access to the ocean so that the yard's products could be easily transported on conventional cargo barges to the open sea, and be close to rail, highway, and inland waterway transportation, preferably in an existing industrailized area. J. Ray McDermott's yard in Louisiana employs 2400 people. It would take a minimum of five, and more probably eight, years to reach such an employment level in a new yard.

Ultimately, State and local controls will determine whether any such facility is located in a given area. The location of a platform fabrication yard in a frontier area would be a major industrial development, although the magnitude of its impacts would be determined by its size, capacity and range of products constructed. Such a facility would have an impact similar to other large scale construction and assembly complexes.

Possible Constraining Factors

The investments and resulting facilities and employment anticipated to result from this proposed sale depend on availability of investment capital, as well as labor and materials.

Funds for capital spending in the petroleum industry come largely from accumulated profits; the remainder coming from borrowing and stock offerings. While declining profits and increased taxes caused predictions that exploration and drilling would be cut back in 1975, actual and planned cutbacks in these activities in 1975 were not as extensive as those in refining and marketing. The cutback in refining and marketing reflect regulations which lessen the profitability of these sectors, while strong demand and higher prices were among other factors attributed to the strong drilling and exploration in 1975. Capital can be allotted where the highest return is expected. Allocations can also be shifted between drilling and producing regions, as well as between different sectors of the industry. For this reason, we do not expect capital availability to be a restraint to the development of the Baltimore Canyon.

Recent supply difficulties in the oil industry stemming largely from steel shortages, affected tubular goods used in the offshore industry. However, present indications are that this shortage has eased. While spot shortages may persist, they are not expected to pose a serious constraint for Baltimore Canyon development.

With regard to drilling rigs, a surplus is developing, according to an article in Business Week (9/1/75), which reports that there will be more rigs delivered this year than can be absorbed by industry. In two years, the 157 drilling rigs under construction will add to the existing fleet of 300. Lessening activity in the Gulf of Mexico, and unfavorable results or conditions in foreign areas should also increase the availability of rigs for use in U.S. frontier areas. A drop in the operating cost of drilling rigs is accompanying the developing surplus.

Dixilyn International, Inc. indicates slightly different statistics (W.N. Plamondon, Jr., Written Testimony, DES for Proposed OCS Lease Sale No. 40, 1976). As of January 1, 1976, worldwide there were 256 active competitive exploratory mobile rigs. Sixty-six of these units are working in the Gulf of Mexico and two are working offshore California.

Worldwide today there are at least 30 units "stacked" and not working. There are 3 units stacked in the Gulf of Mexico and at least three additional units which will be available in a short time.

In addition, there are 107 units currently under construction in the world. Sixty-eight of these units do not have contracts. Twenty-

nine mobile units are under construction in U.S. shipyards and two units in Canada. A number of these units do not have contracts for employment.

There continues to be a shortage of petroleum engineers and highly skilled rig and platform workers. Petroleum engineers are being supplemented by other types of engineers who are provided training in the petroleum field. Likewise, skilled workers are being developed through on-the-job training. Many skills found in other industries are easily adaptable to the offshore petroleum industry (e.g. welders and mechanics). While skilled specialized labor could present a problem, the nature of the labor force in the Mid-Atlantic coastal region, unemployment levels, and training programs should be able to alleviate the problem to the degree that it will not pose a major constraint to development in the region as a result of this proposed sale.

b. Economic Impacts

This section has used, as a basis for its analysis, the results of a study[1] assessing the impacts of possible oil and gas development

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[1]Technical Paper Number 1--New York OCS Office: Economic Study of the Possible Impacts of a Potential Baltimore Canyon Sale. Available from National Technical Information Service. Accession code PB249199/AS. Also available from the Bureau of Land Management.

from the proposed sale upon the Mid-Atlantic coastal region under a rigid set of hypothesized assumptions. For purposes of this statement we have used the results of this study to draw implications as to the extent of the onshore impacts that could be expected to result from this sale, and to identify the key factors upon which the magnitude of the socioeconomic impacts are sensitive.

While the Harris economic model and the methodology used for the economic study has its limitations with regard to the exact prediction of future economic variables, we have not used the economic study for this purpose, but have instead drawn upon the study to provide an understanding of the extent of the impacts, flag some of the potential onshore problems, and provide a greater understanding of the factors that could determine the possible socio-economic impacts should Sale No. 40 occur. Concern has been indicated that the economic study draws upon National coefficients to represent regional conditions. National coefficients have been utilized because regional coefficients for all areas are not available. Dr. Harris has conducted tests as to the sensitivity of the economic model to variation of the regional coefficients from the national coefficients and concludes that a 50% difference in regional conditions from national coefficients would be needed before a change in effect is shown. These findings suggest that for our purposes the economic study is a useful tool. The economic model and the methodology used does, however, have its limitations and a careful use of the results of the economic study is advised; exact prediction of future economic variables can not be made.

Should the proposed action be taken, economic opportunity can be expected to shift to areas involved in supporting Baltimore Canyon activity. Labor, capital, and materials can be expected to be drawn to these areas in response to shifting economic opportunity. The nature of the factors of production which may be affected by the proposed sale are described in the introduction to this section (III.D.1.a.). The ability of a locality to absorb the movements of these factors of production is dependent on the specific area's population and industrial base. Those factors of production which cannot be utilized in a given locality can be expected to undergo further movement over time to other areas of greater economic opportunity. We are concerned with the changes of economic opportunity within the region, the respone of labor, capital, and materials to these changes and the effects of these movements and their activities on the existing economic structure within the Mid-Atlantic coastal region.

Should the proposed sale, occur, the impact on the regional economy could be expected to be minor. Changes of less than one percent from base case levels for most economic variables (including employment and income) could be expected to result. The greatest changes would occur in construction activity, the balance of payments, and private investment. These changes, however, at the most should be only between one and three percent from base case levels. An example of the changes that could be expected for the region as a whole follows.

A maximum employment multiplier of 4.3 was obtained by an analysis of the high recoverable resource estimates. For every person directly employed in those jobs listed in Table III-31 , it is anticipated that at the most another 3.3 jobs would be induced in the region as a whole. Using recoverable resource estimates ranging from 0.4 billion to 2.6 billion barrels of oil and 2.6 to 12.8 trillion cubic feet of gas, the proposed action would be expected to increase the number of jobs in the region at the most (high case ) from approximately 4200 to 15,4000 persons of which approximately 900 to 3600 would be directly employed by OCS-related activities. Not all of the increased jobs in the region would be filled by persons coming from outside the region. The highest ratio between increase in civilian employment and increase in population obtained in the analysis of the high discovery case was applied to estimate possible maximum population increases.

Maximum population increases for the region as a whole could be expected to range from 5600 to 20,000 persons. These increases are less than one percent from base case levels. With this as a background the impacts of the action on industry, localities, and the region as a whole can be presented.

## Induced Industrial Effects

### (1) Pipelines Except Natural Gas

Establishments primarily engaged in pipeline transportation of crude petroleum would need to expand their activities to offshore areas as well as new onshore areas to allow Baltimore Canyon crude oil to reach existing refineries. Activity in establishments primarily engaged in the pipeline transportation of refined products of petroleum, such as gasoline pipelines (common carriers) and fuel oil could be expected to be only minimally affected should the crude petroleum found in the Baltimore Canyon as a result of this proposed sale alter the product mix of refineries.

### (2) Petroleum Refining, Gas Processing, and Related Industries

Production of oil from the proposed Baltimore Canyon sale can be expected to flow to existing refineries located within the area. Much of the imported oil now being used in these refineries can be expected to be replaced by OCS production. It is felt that new refineries will not be built as a direct result of production that may stem from the leasing area. Decisions to build new refineries are highly complex. They include consideration of demand, market location, supply of crude and other factors, such as the national and regional economic climate.

Alternatives to the option of building a new refinery include substitution of foreign crude with OCS oil, greater utilization of existing refinery capacity, and the expansion of existing refinery capacity. These alternatives seem most likely to be taken in the Mid-Atlantic coastal region as suggested by the recent closing of the Amerada Hess refinery and given the great uncertainty surrounding the decision to invest in new refineries. It is felt that production of from 90,000 to 740,000 barrels of oil per day in the Baltimore Canyon anticipated as a result of this proposed sale could be adequately handled by the 1976 capacity in the region of 1.43 million barrels of oil per day and would not stimulate the construction of a new refinery in the region.

Arthur D. Little, Incorporated, in Potential Onshore Effects of Deepwater Oil Terminal-Related Industrial Development, has estimated that existing refinery capacity in the Mid-Atlantic could be expanded to 2.3 million barrels per day on site, that is, with no new refineries. It is more likely that any Baltimore Canyon oil production stemming from this proposed sale will replace imported crude. It is acknowledged that the quality of crude oil to be found in the Baltimore Canyon may preclude the substitution of all foreign sources of crude reaching the Mid-Atlantic coastal region's refineries. It is unlikely, for example, that asphaltic crude imported from Venezuela will be replaced

by a non-asphaltic crude that may be found in the Baltimore Canyon OCS. The fact that the Baltimore Canyon OCS crude oil may be either a sweet or sour crude appears to be no problem with regard to the existing refinery capacity in the area being able to process the crude oil.

We could therefore expect a decrease in the level of economic activity related to foreign oil transport in the ports which would no longer receive imported crude oil, and an increase in the level of economic activity in the areas in which terminals would be built to handle the new OCS oil. Imports of oil should decrease by the amount of OCS oil production from this sale and balance of payments should improve by the value of the imported oil being replaced. It is not likely that the action would allow oil to become more readily available for use in the area. It should, however, decrease the amount of dollars flowing out of the region to purchase oil being produced elsewhere. A greater amount of the area's income would remain within the Mid-Atlantic coastal region's spending stream. Benefits can be expected to be enjoyed by those in the region to the degree that oil is domestically produced from the Baltimore Canyon, imported oil is replaced, and the dollars spent on the OCS oil remain within the expenditure stream of the area.

Production of gas from this proposed Baltimore Canyon sale could result in fewer curtailments of gas contracts in the Mid-Atlantic coastal region. Natural gas consumption in the area has been encouraged by a low regulated price,

convenience, and cleanliness. Pipelines from the Gulf of Mexico and the Southwest carry natural gas to the region and were built to carry supplies at times of peak demand. The present pipeline distribution system can be expected to be utilized although new pipeline construction would be needed to connect the flow of Mid-Atlantic OCS gas to the existing pipeline systems. The area does not have any gas processing capacity. If recoverable amounts of gas should be discovered in the Baltimore Canyon, new gas processing capacity would need to be built. Establishments primarily engaged in processing liquid hydrocarbons from oil and gas field gases would need to be introduced into the area. Gas pipelines could be expected to flow to and from these gas processing areas connecting with the existing pipeline distribution system.

A heavy burden has been placed on the Mid-Atlantic coastal region by the curtailment of deliveries, inability to add new gas customers, and the importation of liquified natural gas at a price higher than the domestic price. Gas production from this proposed sale could serve to alleviate future gas problems in the Mid-Atlantic coastal region to some degree but would not be able to alleviate present problems.

(3) Water Transportation, Transportation by Air, and Transportation Equipment

Transportation activities of supporting offshore oil and gas operations from operations bases and possibly receiving offshore production are not presently found in the region. New activities in these sectors could be expected in the provision of supply and crew

boat services and helicopters. If tankers were utilized to transport OCS oil, United States tankers would be utilized and would be smaller than vessels currently transporting imported crude oil. Existing interregional, intraregional, and interharbor facilities would also be utilized. Air cargo and air passenger transportation may also receive increases due to increased activities needed if this proposed sale is held.

(4) Rubber and Miscellaneous Plastics Products

This industry shows linkages with other industries. The nature of the crude oil found in the Baltimore Canyon could be a factor in the activity of this industry in that the sulfur content of a high sulfur crude oil should be removed to avoid deterioration of the quality of the environment. This removed sulfur content can be utilized by the rubber industry. It is not likely that new establishments would be stimulated in the area should the proposed action be taken. Expansion of activity in this industry, however, is most likely. The stimulation of new establishments near existing refineries and petrochemical plants is more likely should there be significant high sulfur crude oil. Products of this industry are also likely to be induced by changes in population should the proposed action be taken. This industry could benefit to the extent that shortages of fuel supplies and other inputs are avoided by the proposed action.

(5) Chemicals and Allied Products

The chemicals industry is one of the industries most likely to expand its activity should OCS oil and gas be produced as a result of this proposed sale. Its relationship to other industries, especially petroleum refining, gas processing and related industries as well as rubber and miscellaneous plastics products and the consumer is extensive. Activity in this industry is sensitive to many of the changes of labor, capital, and materials that could be expected. This industry would benefit to the extent that the proposed action may lessen shortages of fuel and other inputs needed for its productive processes. Other industries will benefit if increased production in the chemicals industry would avoid shortages of input supplies for other productive processes.

Expansion of chemicals or allied industries near existing petroleum refining areas would be more likely. The existing establishments in the industry could be expected to expand their activity, thereby minimizing the impact on low population density areas (Type III and IV, 0-1000 persons per square mile and varifing economic bases, as described in Section III.G.2.b.). In areas where existing firms operate, stress levels on the environment may already be high. Expanded activity in these high population density areas (Type I and II, densities greater than 1000/square mile) could increase the amount of pollution emissions entering the environment. The option of expanded

activity of this industry into low stress areas may become apparent and should be considered and studied should the problem arise.

(6) Finance, Insurance, and Real Estate

Some of the capital needed to finance the primary investments of the proposed action could be expected to be drawn from this industry. A substantial portion of the capital, however, would probably be drawn from sources outside the region. A greater proportion of the financing for secondary investment could be expected to be drawn from within the region. An initial influx of capital could be expected to be drawn to primary impacted areas during the earlier years. Some reallocation of capital within the region could also be expected to occur. Over time, however, induced capital levels should decrease and become more widely distributed with a greater proportion of the capital stemming from sources within the region. Land values could be expected to change with the shifting of economic opportunity over time.

(7) Machinery, Except Electrical

The existing establishments in the region should be able to meet the needs of Baltimore Canyon OCS activity, stemming from the proposed sale, minimizing the need for new establishments to be created in this industry. Establishments primarily engaged in manufacturing drilling tools and other machinery specialized

to oil and gas extraction are included in this sector. However, many of these activities occur outside of this region. It is possible that some establishments would adapt their existing processes to meet some of the equipment demands associated with offshore development.

(8) Primary Metals Industry

The output of this industry could be expected to be utilized during the earlier years of the proposed Baltimore Canyon activity. The widespread prevalence of the industry throughout the area would minimize the likelihood of new establishments being stimulated by the requirements of the proposed action. Requirements for output from this industry should lessen during the later years as needs shifted to lighter and more service-oriented industrial requirements. This industry and others should benefit to the extent that the proposed action avoids dislocation of labor, capital, and materials stemming from storages of fuel or other inputs into production processes.

(9) Building Construction--General Contractors and Operative Builders

This industry could be expected to respond to changes in population levels. The change in the level of activity could be expected to occur only after it was known whether a population change could be considered permanent. The decision to expand or limit the level of activity could be expected to be made only after the existing capacities and the expected utilization are considered.

The presence of excess capacity in a locality may lower the induced demand for this industry's activities. The initial influx or outflow of population caused by the proposed action is not likely to be an indication of the permanent population levels that could be expected in a locality. Likewise, industrial and commercial firms entering the area may also be temporary. It is possible that an industrial or commercial activity would be needed in an area only for a limited period of time after which the activity could be needed elsewhere. The type of the construction (temporary or permanent) required to support the proposed action should be based on the dynamic nature of the economic activities expected. General contractors and operative builders are extremely mobile due to the nature of their work and may be expected to move to areas where their services are required.

(10) Construction Other Than Building Construction--General Contractors

This industry can be expected to respond to changes in demand for infrastructure should the proposed action be taken. Initial expansion of activity in this industry should be tempered by a feeling for the level of permanence associated with the influx or migration of labor, capital, and materials into or out of a given area. It is likely that siting decisions would be such that existing infrastructure in the area would be utilized when it is feasible to do so. In this way major infrastructure expeditures could be minimized. Industry might have requirements that necessitate construction in remote areas which may require new infrastructure construction.

Utilization of major systems and networks could be expected with construction activity within this industry being taken to connect activities in isolated areas to these existing systems. Major new infrastructure systems would be more likely to be built in low population density areas (Type III and IV). Establishments found in the area would be expected to move to areas where demand for their services presents itself.

(11) Construction-Special Trade Contractors

This industry can be expected to respond to changes in demand associated with changes in population should the proposed action be taken. With additional pipelines being built, gas leakage detection would need to be expanded onshore and extended to offshore areas. Some new establishments in this industry could be expected to be introduced into the area should the action be taken.

(12) Mining and Quarrying of Nonmetallic Minerals, Except Fuels

Should the proposed action be taken, a prime user of this industry's output, the construction industry, can be expected to increase its economic activity and use of such products as dimension stone, crushed and broken stone, sand and gravel, clay, ceramic, and refractory minerals. An increase in the level of activity of this industry could be expected to meet the demands of the construction industry should the proposed sale be held.

Recoverable amounts of sand and gravel exist in offshore areas outside the leasing area (Visual 3). Should the proposed action be taken, there is a possibility that a sand and gravel lease sale in these other areas could be stimulated. The demand for sand and gravel relative to the supply in the area is increasing. Offshore mining of sand and gravel is competitive with onshore mining. As the onshore sand and gravel resource base is depleted within the region, it is possible that producers will look to offshore areas for additional supply. Offshore mining of sand and gravel will require port facilities and areas along the coast for processing plants. Coastal zone managers should be alerted to this possiblility.

(13) Electric, Gas, and Sanitary Services

The level of this industry's services usually vary with population density. Should the proposed action be taken, those areas which experience population increases could be expected to provide greater services. A critical problem in the area is the availability of natural gas supplies. Baltimore Canyon gas production should allow establishments engaged in the transmission, storage, and distribution to better meet the area's consumer and industrial demand for natural gas in future years and future shortages of natural gas in the region may be avoided. The action will not affect short run problems of dislocation that may occur in the region from possible shortages of natural gas in the next few years. Increased demands stemming from increased population and economic activity could also put increased stress on existing water

systems and sanitary systems, requiring increased expenditures so as to allow the capacities of these systems to meet a given area's needs. Remote areas (Type III and IV) may require expanded activity of these services to meet the increased demands of a newly populated community. Adequate technology and planning are required in all areas to avoid air pollution, water pollution, solid waste, and power shortage problems in the area that may be created by shifting populations and economic activity should the proposed action be taken.

(14) Retail Stores

The retail establishments are sensitive to market demand and are more prevalent in more urban locations (Type I and II). Induced activity in this industry could be expected to become more widespread as population and economic opportunity becomes more widely distributed in the region over time. Changes in activity in this industry are likely to be significant should the proposed action be taken.

(15) Public Administration

Greater federal revenues should return to localities as production from the proposed sale moves toward peak level. Increased state and local government activity within the Mid-Atlantic coastal region would be needed to support Baltimore Canyon activity over time. The activities of some state and local governments could rise while those of others could fall. Increased monies needed by some state and local governments should be available by increased revenues generated by the increased level of economic activity, although the increase in monies may not always meet the demands.

(16) Wholesale Trade; Local and Suburban Transit and Interurban Highway Passenger Transportation; and Railroad Transportation

These sectors could all be expected to be utilized as a result of population increases or economic activity stemming from this proposed sale. Only small changes in response to shifts of population or change in population levels would be expected, however.

(17) Fishing, Hunting, and Trapping

Commercial fishing could be impacted economically by the proposed sale in four ways: 1) if the resource base itself (commercial fish and shellfish) is lowered as a result of an oil spill, 2) if offshore commercial fishing areas are removed because of rig and platform placement, 3) other obstructions, such as pipelines, to fisheries operations, and 4) if competition for labor, equipment and harbor space should draw these resources from the fishing industry to OCS-related activities. The first three items are discussed in section III.C.2.

Our analysis indicates that the proposed action would not result in a decrease in employment and output in this sector. This may be due to the fact that a substantial non-fisheries marine industry exists in the Mid-Atlantic, from which labor and equipment not imported from outside of the Mid-Atlantic region could be drawn. While our analysis indicates that is it unlikely, it is possible that competition for port or harbor facilities could adversely impact the fishing industry on a localized basis as has occurred in the North Sea area. It is not possible to indicate where or to what extent this might occur in the Mid-Atlantic.

## Impact on Localities

The extent of the impact on a given locality is sensitive to the amount of dollars remaining within its spending stream or economy for additional rounds of spending. Population can be expected to respond to private investment. This investment represents economic opportunity to labor. Other factors of production (capital and materials) could also be expected to respond to economic opportunity by migrating to the investment area. The more a local economy is able to absorb the newly invested dollars within its spending stream, the greater will be the benefits, in the form of job opportunities, per capita income, etc. accruing to its population. A more populated and industrialized area (as Types I and IIb, described in Section II.G.2.) is better able to absorb the dollar injection into its economy. Impacts would be less significant in these areas although there is some chance for congestion problems to be induced. Migration of labor, capital, and materials to these areas could be expected to be less than the migration of factors of production required to utilize the same amount of investment made in less populated and industrialized areas (Type IIIa and IVa areas). The existing population and industrial base in Type I and IIb areas is more able to effectively utilize a given level of investment.

In analyzing the impact that the proposed action would have on the localities of the region, the question becomes one of determining how much economic activity would be induced by the investment in relationship

to the existing level of local activity. As was indicated, the impact for the region as a whole was found to be minimal.

It was found, however, that the possible impact on a locality could be significant.[1]

> Private investment could represent a change of nearly 200 percent from base case levels for a Type IVa county, (lowest population and most limited industrial base), resulting in as much as a 10 percent increase in population, 14 percent increase in income, 15 percent increase in jobs, nearly 200 percent increase in equipment purchases, 150 percent increase in construction, and 14 percent increase in personal consumption expenditures from base case levels.
>
> Private investment could represent a change of nearly 150 percent from base case levels for a Type IIIa county, (limited industrial base, 251-1000 persons per square mile) resulting in as much as a 6 percent increase in population, 8 percent increase in income, 6 percent increase in jobs, 63 percent increase in equipment purchases, 183 percent increase in construction, and 7 percent increase in personal consumption expenditures from base case levels.

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[1] Technical Paper Number 1--New York OCS Office.

Private investment could represent a change of nearly 24 percent from base case levels in a Type IIa county, (high density, limited heavy industry), resulting in less than 1 percent increase in population, 1 percent increase in income, 1 percent increase in jobs, 20 percent increase in construction, and 1 percent increase in personal consumption expenditures from base case levels.

For a given locality, particularly the least developed (Type IVa), the investment that could result from the proposed action could represent a heavy shock to its economy in terms of its existing level of economic activity and its ability to absorb the increases of labor, capital, and materials that have migrated to it. We can expect some, but not all of these factors of production to be absorbed by the local economy, and those that cannot be absorbed to move over time to other areas and other local economies within the region where the ability to be absorbed is greater. We can expect some local economies to lose labor, capital, and materials in response to economic opportunity being created in other areas, but these losses could be expected to be minimal (less than 1 percent from base case levels). Only primary impacted counties that are unable to absorb the initial influx of labor, capital, and materials can be expected to show a significant outflow of these factors of production over time.

Any investment activity taken in a county in the Mid-Atlantic coastal region to support exploration, development, or production resulting from the proposed sale will stimulate an increase of investment in other sectors depending on the extensive and diverse nature of the existing industrial base within that particular locality. This stimulation is based mainly on an increased demand for related products. Linkage effects are caused by the utilization of one industry's output by another industry. The greater the economic interrelationships existing between sectors in a county the greater will be the linkage effects and impacts caused by a sale-related investment. The magnitude of the impacts will vary, to the extent that this investment stimulates new or expanded industrial activity within a county.

Linkage effects as described above are greatest in counties where the output of one industry can be utilized as input by another industry. This is more likely to occur in the more industrialized counties (Type IIb, IIIb, IVb). For example, it is likely that the proposed action could result in a greater availability of natural gas. Industries utilizing natural gas elements as inputs into their productive processes might be able to expand their level of economic activity. It is also likely that consumers would benefit from the greater availability of natural gas in all areas where shortages currently exist.

The introduction of activity related to the proposed sale into a county containing a narrow economic base (Type IIIa and IVa) may provide a particular county with the opportunity to lower its dependence on outside areas by producing more of its needed goods and services and increasing its export earnings capability. The leasing of the proposed tracts may widen the industrial base of a given county so as to provide the county with a greater and easier ability to gain export earnings to purchase needed goods and services produced outside the county. A county dependent on the tourist industry, for example, in expanding its industrial base, might be able to lessen its dependence on outside areas and vulnerability to the fluctuations and uncertainties associated with the seasonal tourist industry. Many of the problems associated with an unstable, unpredictable, and limited economic base might be able to be avoided by widening the industrial base and providing the economy with more certain earning power so as to meet the needs of the people within the county.

Some persons in the area under consideration have indicated that their tourist economy with its limited industrial base is quite healthy and there is concern that heavy industrialization would result in the permanent loss in the revenues that stem from tourism. It is felt that heavy industrialization stemming from the influx of oil and gas operations, in combination with other potential developments is incompatible with their tourist economy. A preference for a tourist based economy is held since in the long run it could be more stable

than an oil and gas based economy. Concern was also raised that along with potential deepwater port facilities, a floating nuclear plant, and other facilities proposed, OCS development could accelerate a trend towards urbanization. It is clear that planning is required to avoid many of the adverse impacts that could result from the introduction of oil and gas operations into a locality with a limited based economy. Some localities might not have the adequate resources necessary to plan for the introduction and integration of oil and gas operations into their limited economies so as to safeguard long-term economic stability, and may require financial assistance to do so.

Certain problems with the data used to describe the existing environment of localities with tourist based economies have become evident. The basic problem lies in the fact that much of the population and employment existing during the peak tourist season is not reflected by permanent population and employment levels. To describe the economies with permanent level figures would be to understate the needs of these tourist economies which serve nearby more populous urban areas and provide an extensive range of social services during peak season to those persons visiting the coastal areas.

For example, Cape May County, New Jersey, has indicated that 1973 and 1974 population levels were 67,200 and 70,600 persons, respectively, and 1974 and 1975 civilian labor force levels were nearly 29,500 and 30,100 persons, respectively. While our figures from the economic model are somewhat lower

for Cape May County, there is agreement on the importance of the tourist economy to the locality and the areas it serves. For a further discussion of the economic aspects and importance of the tourist industry in the area, see Section III.D.1.e.

Even with planning, however, the initial and rapid influx of labor, capital, and materials into these types of areas could lead to problems in absorbing the influx, because of a narrowness of the economic base. Low population and unindustrialized areas would probably experience a rapid outflow of these factors of production due to their limited ability to accommodate the influx. For example, an influx of labor, capital and materials, needed for construction activity would occur if an operating base and pipeline terminal were to be located in a particular area. But if the economy of the area is not diversified, other activities would not be stimulated, further construction activity would

not take place to any significant degree, and only the facilities themselves and associated employment would remain. Problems of over-extension may appear as these resources move to other areas. Developers are not expected to commit resources to the construction of infrastructure until a knowledge of the level of the factors of production to be absorbed by the local economy becomes more certain. Because of this it is not likely that the area as a whole would experience a boom/bust phenomenon. The possibility of a boom/bust cycle is most likely for a locality with low population density and a limited economic base (Type IIIa and IVa). Stress on existing infrastructure at the time of initial influx of labor, capital and materials would occur in any case, particularly in these low population, limited economic base areas. A further discussion of these impacts is undertaken in Section III.D.1.c.

The costs associated with the proposed action for a locality are not sensitive to recoverable resource levels as much as they are to the timing, location, nature, and level of investments being made. It is likely that costs for the Mid-Atlantic coastal region as a whole will be less for lower recoverable resource amounts. It is quite possible, however, for comparable costs to be incurred by a locality for substantially different levels of recoverable resources of oil and gas depending on the distribution of the oil and gas and the resulting unitization of its flow to shore.

For example, for the low discovery case anticipated as a result of this proposed sale (0.4 billion barrels of oil and 2.6 trillion cubic feet of gas), one pipeline terminal and three gas processing units are anticipated to be required. The terminal and two gas processing plants could be located in one county. This same level of facility development may occur in the same county under a higher discovery case, with other facilities being disbursed to other areas. While the impacts to the region would be greater if more resources are recovered, the impact on the locality, in this case, would be substantially the same.

Regional Impacts

The increase in population for the area as a whole can be expected to be only modest (a maximum of from 5600 to 20,800 persons). Not all skills needed for exploration, development, and production are found in the Mid-Atlantic coastal region. These skills would be imported from outside the region. Population within the region would be drawn during the early years to the coastal areas nearest the proposed sale area where most land based supporting facilities are expected to be located. Offshore oil and gas activity would induce increased economic activity for a period of greater than 25 years in the form of a shift from heavy industrial activity in the earlier years to more service-oriented economic activity during the later years. In the later years population would be drawn to more areas within the region. This is indicative of induced increases in economic activity becoming more widely distributed throughout

the Mid-Atlantic coastal region during the later years of activity in the proposed sale area. The level of induced activity could decline after peak production is reached (after 1990).

Persons from outside the Mid-Atlantic coastal region would be attracted to the area by increased job opportunity. If primary facilities are located in low population areas with limited industrial bases, such as along the southern New Jersey shore, the high number of persons entering these areas during the earlier years of activity is not expected to be permanently absorbed. Much of the remainder of the Mid-Atlantic coastal region would be able to absorb these persons during the later years. Induced increases in income would be experienced by the Mid-Atlantic coastal region as a whole. These increases would become more widely distributed throughout the region over time. Resources would be attracted mostly to primary impacted counties during the early years of OCS sale-induced activity. These resources would be mostly drawn from outside the Middle Atlantic coastal region. A noticeable reallocation of resources from within the region to these primary impacted counties should also occur during these early years. Resources would be more widely distributed within the region as economic activity itself becomes more widely distributed within the region over time. More resources would be drawn into the coastal state areas within the region during the later years of activity than are drawn out of the coastal state areas in the earlier years. Private industry could invest heavily in the Mid-Atlantic coastal

region to support OCS sale-induced activity. During the later years, private industry could invest lesser amounts but to more areas than during the earlier years. Resources could be expected to be drawn from both unemployed and employed ranks.

Greater Federal revenues would return to localities as oil and gas production moves toward peak levels. In general, increased State and local government activity within the Mid-Atlantic coastal region would be needed to support the proposed Baltimore Canyon activity over time. The activities of some State and local governments would rise while those of others fall. Increased monies needed by some State and local governments would be available as reflected by increased revenues generated by the increased level of economic activity. This availability for some localities, however, could be restricted by the level of recoverable resources found in the proposed lease area.

Induced increases in petroleum refining activity (including gas processing) for the Mid-Atlantic coastal region as a whole would be greatest around 1985. Production from the proposed leasing area should induce an increase in petroleum refining activity for the region as a whole. Some excess capacity and allocation problems in this sector may appear.

The existing industrial sectors of iron, steel, other metals, machines and other manufacturing, chemicals, and plastics would be heavily relied upon during the initial years of Baltimore Canyon activity. The existence and proximity of these heavy industrial sectors to primary impacted areas

should decrease the incentive for industry to build new heavy industry; wholesale trade, retail stores, and transportation activities should face increased expansion throughout the region over time. The gas utilities of the area would show the benefits of gas being available for the region's use as production of gas increases. The proposed action will have no effect on present gas availability problems.

The greatest induced increases of economic activity would be in the petroleum mining and construction sectors. Much of the materials for platforms and wells would be purchased from outside the Mid-Atlantic coastal region, shipped to the area, and constructed within the area. The most active construction sectors in the Mid-Atlantic coastal region would be the oil and gas well drilling, gas and petroleum pipeline, and industrial construction sectors. As oil and gas production increases, induced increases in construction could be expected to become more widely distributed within the Mid-Atlantic coastal region. Those sectors purchasing the most equipment would be the oil and gas well, construction and transportation sectors. Wage rates paid in the construction sector and some land values could rise. A new wage structure for newly established offshore activities could be initiated into the area.

A decrease in port activity is expected to be induced by the replacement of oil imports with Baltimore Canyon oil production as a result of the proposed sale. Improvements in the balance of payments would increase as oil production from the proposed sale area reached peak level. Other benefits could

include a rise in national income and gross domestic product. Significant increases in economic activity outside of the Mid-Atlantic region could occur in the machines and other manufacturing, iron, steel, other metals, chemicals, plastics, petroleum mining, and wholesale trade sectors. Oil and gas produced from this proposed sale would allow the Mid-Atlantic coastal region to depend less on petroleum mining and petroleum refining sectors outside the region. Expansion of existing refineries could result in the expansion of petrochemical activity, given the restriction that emission levels do not surpass legislated standards.

It is not likely that the area as a whole would experience a boom-bust phenomenon. The impact of this proposed Baltimore Canyon activity on the Mid-Atlantic coastal area as a whole should not be great enough to pose such a threat given the existing infrastructure, industrial base, and population found in the region.

Many of the activities needed for sale-induced exploration, development, and production may be found to occur in other areas of the United States. Many of the offshore operating firms are based in the Gulf of Mexico. A decision to locate new firms in the Mid-Atlantic coastal region must be based on certainty and knowledge. The outcome of the exploration activities will determine whether adequate amounts of recoverable resources of oil and gas are present to warrant the development and production of the resources. The amount and distribution of recoverable resources found in the proposed leasing area must be of a great

enough quantity to provide an economic incentive for these firms to invest the needed funds to relocate or expand in the area.

The costs and benefits stemming from the proposed action will be sensitive to the level and distribution of recoverable resources proven in the proposed lease area. Production of less oil and gas in fewer areas will induce smaller changes in income, employment, and population in the region as a whole. With lower and more concentrated finds of recoverable resources, there would be fewer primary impacted areas, less private investment in all the primary impacted areas, fewer areas receiving induced effects, and a lower level of induced effects. The timing and location of these impacts would be affected by the level and distribution of recoverable resources found in the proposed lease area. There is a possibility that the impact of the proposed action could be significant for some localities. It is most likely, however, that for the region as a whole the impacts of the proposed action will be minor.

c. Population Impacts and Effects Upon the Infrastructure

The social and physical infrastructure of an area may be affected in numerous ways by onshore development and OCS-induced growth, but rapid population increases would have the greatest effect. Any rapid population growth in a particular area would have an ensuing impact upon the housing supply, school system, water supply, sewage treatment, solid waste disposal, and other necessary public services.

Within this section, expected changes in population resulting from the proposed action will be examined both on a regional and subregional or county level. The effects of such increases on the physical and social infrastructure of an area and upon its socio-cultural characteristics will then be discussed.

During 1986, the anticipated peak employment year, estimates of the maximum increase in population within the Mid-Atlantic region range from approximately 5600 to 20,800 persons induced by the proposed OCS development. If the actual population increase falls within the aforementioned range, these persons would account for much less than one tenth of one percent of the projected 1986 regional population. By 1986 without OCS development, the regional population is expected to reach 33.2 million people, an increase of 16 percent or 4.5 million persons over the present population.

The OCS-induced population increase would, for the most part, be caused by the in-migration of persons employed from outside the region and their families. During the earlier years of operations, there may be a

greater influx of persons into the area in search of employment and related opportunities with a tapering off of this trend in later years. If all jobs -- direct, indirect, support, induced, etc. -- are filled by persons from outside the region, the resultant population difference would probably still be less than one-tenth of one percent of the population of the coastal region.

The overall rate of population growth within the region between 1970 and 1990, an average increase of 1.5 percent per year, will not differ greatly from the rate of growth that took place between 1950 and 1970. The OCS-induced population gains within the region probably would not alter that rate of growth by more than five hundredths of one percent between now and 1990. Due to the very minimal population gains associated with proposed OCS development, no alteration in the population characteristics (density, urbanization, age, minority distribution) of the region are anticipated. If the proposed action does take place, the economic analysis[1], under the high discovery case, indicates that by 1990 there would be less than 9000 additional persons, directly attributable to OCS development remaining in the region. This figure is lower than an expected 1980 high of approximately 11,300 persons. Figures resulting from this analysis were the result of many hypothetical assumptions; therefore, many uncertainties exist.

[1]Technical Paper Number 1--New York OCS Office: Economic Study of the Possible Impacts for a Potential Baltimore Canyon Sale. Available from National Technical Information Service, U.S. Dept. Commerce. Accession No. PB249199/AS. Also available from Bureau of Land Management.

The magnitude of OCS-related population increases within the region would depend upon many varying conditions. The most important factor is the actual OCS development scenario which emerges; which in itself is dependent upon many economic, social, environmental, and political factors. Realizing that the resultant population projections cannot be made with any degree of exactitude, it is still expected that OCS-induced regional population growth will be insignificant, amounting to less than one-tenth of one percent of the region's present population.

In order to better perceive the population effects of OCS development it is necessary to examine them on a subregional and county basis. Some areas are more likely to receive impacts than others, depending upon where OCS-related primary industrial activity takes place. A discussion of where these activities are most likely to locate is included in Section III.D.1.a. and d.

For purposes of discussion, any segment of the coastal region in which primary OCS-related industrial activities may locate will be referred to as a "primary" area, "primary" county, etc. Counties which will experience the most growth during the early years of OCS operations are those counties in which direct investments may be made or offshore-related primary industrial activities may be located in order to support the proposed Baltimore Canyon development. It is most likely that favorable investment and locational decisions could result in the utilization of areas that are closest

to the proposed lease acreage that exhibit desirable conditions necessary to support the offshore industry. Areas in close proximity to the proposed lease acreage, which may have amenities desireable to the offshore industry, could be found within the Atlantic shoreline counties of Sussex, Cape May, Atlantic Ocean, Monmouth and the five counties of New York. For a detailed discussion of the factors which influence a locational decision of OCS-related primary industrial activities, see Sections III.D.1.a. and d.

OCS-induced population growth within counties sustaining primary industrial activity will be the result of intraregional and extraregional migratory trends caused by persons seeking greater employment and other related opportunities. It is expected that there will be a greater influx of persons into these counties during the early phases of operations. Some counties, depending upon their economic base, could be able to absorb and maintain the induced population through the development period (for example, Kings County). In other counties (for example, Atlantic, Cape May) in which the economic base and/or infrastructure system cannot absorb the additional population, it is anticipated that net out-migration would be experienced during the latter operational years (after 1980 in some cases and 1985 in others). The surplus population would be expected to be absorbed by areas surrounding these primary counties. It is likely that OCS-related primary industrial activity could, as a result of the proposed action, locate within the segment of the coastal region which is comprised of New York City and the New Jersey Atlantic shoreline counties.

If this occurs, it is expected that the magnitude of intra- and extraregional migratory trends will not alter the population characteristics and trends in the area as a whole. Based upon the economic analysis[1] it is anticipated that between 1975 and 1990 there will be no change in the area's population as a percentage of the regional population. The area's rate of population growth would also remain at approximately the same level. Although the actual number of persons in the primary area would increase, the number would be relatively insignificant (less than .2 percent of the areas total population) in comparison to the average annual growth rate, 1.2 percent, without proposed OCS development. OCS-induced population growth in the primary area discussed would be insignificant.

OCS-induced population growth on a subregional basis will not be uniformly insignificant throughout the region. Although it is less likely, if primary industrial activity resulting from the proposed sale should locate in an area such as the Delmarva Peninsula, which is generally more rural and less industrialized, the expected population growth would be more significant in that it would account for a greater percentage, between one and 2.4 percent, of the existing population of the area. This might especially be true if support operations were concentrated in a scarcely populated and underdeveloped area, such as Maryland's Eastern Shore, as opposed to the two more developed counties of northern Delaware. Although it has been stated that OCS-induced population growth would be more perceptible at the

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[1] Technical Paper Number 1--New York OCS Office, BLM.

local and municipal level, it will not be discussed below the county level as the smaller the population base, the more uncertain future projections become.

Population changes within each county in the coastal region would result from migration between counties and from outside the region. Primary counties would draw persons who are seeking employment opportunities. Counties which surround such primary counties may lose population through net out-migration. Counties having no OCS facilities would probably show some population losses during the period of OCS development. In the high discovery case, the economic analysis indicates that by 1990, estimated net changes in population at the county level could range from some 2000 persons below the base case to approximately 3500 additional people. The analysis also indicates that substantial population increases in some primary counties could be expected during the intial development phases (1980), but these increases are not expected to be sustained throughout the entire development period.

Population growth as it relates to impacts is a neutral phenomenon. It is the effect of rapid population growth upon the economy, infrastructure, and service systems that may produce positive or negative impacts. From a regional perspective the infrastructure impacts would not be severe due to the generally well-developed nature of the system within the region as a whole; but in areas throughout the region, the

present availability and capabilities of the infrastructure and service systems vary widely.

The most extensive physical and social systems are to be found within the New York City counties in the northern segment of the area. The availability and capability of these systems progressively declines as one moves southward from New York City along the coast. Counties having the most underdeveloped infrastructure and service systems are to be found along Maryland's Eastern Shore and the more northern Virginia counties along the Chesapeake. Counties which are not highly developed may also be found in New Jersey and Delaware (for example, Cape May, Sussex). Some of these areas have very limited sewage and water systems. Road networks in some counties are minimal and poorly designed; other areas are completely devoid of any form of public mass transportation. Unlike the trends for other public service needs, housing availability would be greater in the more southern segment of the area due to migratory trends. Hospitals, educational services, and police manpower are to be found in greater quantities in the more populated areas to the north. Impacts upon the infrastructure would greatly depend upon the distribution of the induced population, whether or not it is widely dispersed and/or the ability of an area, based upon its infrastructure capabilities, to absorb the population increase.

OCS-induced population increases that may take place in a given county would not necessarily require new infrastructure facilities. Some counties within the region have experienced economic decline (for example, Atlantic County), a decrease in their rate of population growth (for example, Nassau County), and/or net out-migration (for example, Prince George County, Virginia). Such developments may have caused the underutilization of a county's physical and service capabilities if these systems were overbuilt.

During the 1950's many communities overbuilt their schools in order to accomodate the "baby boom" following World War II. A number of primary and secondary schools in outlying suburban areas are presently underutilized due to the declining birth rates of the 1960's and trends toward the postponement of childbirth until later years during the family cycle. It is possible that an increase in pupils resulting from the proposed action would merely increase the utilization rate in existing schools. Where present facilities are overutilized the additional pupils could further compound overcrowding of the system or cause new construction in the form of temporary classrooms and/or entirely new schools.

Similar trends may be expected in terms of dwelling units. Demands on housing could be fulfilled through vacancies in existing single family homes and multi-family dwellings or through the construction of new units. In areas having low vacancy rates (for example, New York City), additional demand on their housing could lead to further

overcrowding of structures, prolonged occupancy of substandard housing, and a widening of rent-income imbalances. These impacts might stem from increased prices caused by additional demand and inflationary trends brought on by the added availability of money from higher incomes (in counties such as Cape May, Ocean, Sussex which have a comparatively low median income). Persons such as the elderly, living on low and fixed incomes, are most likely to suffer from these types of developments. Many minority persons could also suffer additional hardships because of the limited housing market in which they are generally forced to operate. New housing starts require long lead times; because of this some of these problems may be encountered on the short term with the market loosening up once new housing becomes available.

It should be noted that there is presently a slump in the housing market as indicated by a decline in the number of new building permits issued. New construction has been seriously inhibited by the unavailability of mortgage monies from the usual sources, who have instead made investments in short-term ventures due to the uncertain nature of the nation's economy.

If demand for additional housing units should take place in an area with comparatively high vacancy rates in their permanent housing market, there could be greater market elasticity, therefore avoiding the extremes of some of the aforementioned problems.

OCS-induced housing demand, although it will be minimal (between 1800 and 7000 units) for the region as a whole, within particular counties or communities, could be a compounding factor in a market suffering from many other complexities.

Generally, effects on other infrastructure facilities resulting from the proposed action may either facilitate greater utilization of those systems, and/or generate demand for new systems. These effects would depend upon the elasticity of the present systems and any planned increases in capacity.

Construction cost expenditures for the expansion of infrastructure facilities that may result from this proposal are not expected to be made until the later years of development when some determination of the permanent population size can be made. Therefore some inconveniences as discussed above, may occur during the short term which will be alleviated during the later development years. See Section III.D.1.b. for a discussion of trends in infrastructure construction expenditures.

Due to the diverse socio-cultural character of this area as a whole, any resulting conflicts of this nature would be felt at the local or municipal level.

Socio-cultural effects will vary both between and within individual counties depending upon population characteristics, and the character of individual counties and communities. In an area in

which a high percentage of the population is elderly, socio-cultural conflicts could arise between them and the generally younger population associated with the proposed offshore operations. In some of the resort counties (for example, Cape May), where a number of the elderly population have purchased their retirement homes, they may be more apt to oppose the encroachment of the offshore industry due both to their unwillingness and inability (due to real financial constraints) to move.

If primary development as a result of the proposal takes place in the more rural counties of the region, the "pace" of life in individual communities could be adversely affected. Such an effect could be more imagined than real. A rapid change in an individual's "pace" of life, whether real or imagined, however, could result in adverse emotional impacts upon that individual. The cultural and moral persuasion of such a county could also be severely altered, as urban lifestyles began to encroach upon the county.

In summation, the visibility of any population impacts would largely depend upon the existing population, its character, and the present infrastructure of the county or municipality in which the growth takes place. On the county level, based upon the economic analysis, it is anticipated that the greatest population difference between the high discovery case and the without development

case could be approximately 10,000 persons (1980). Due to its well developed infrastructure and its diverse socio-cultural characteristics, a population increase of 10,000 persons in the urban industrial county of New York (Manhattan) would virtually have no affect. Such an increase would account for less than one-half of one percent of the county's total projected 1980 population and approximately five percent of the expected population change (between 1975 and 1980) without OCS development. Unless all 10,000 persons move into the same neighborhood at the same time, the change would be imperceptible. If New York could accommodate the base case growth (and with its present financial difficulties, that is debatable), the incremental effect of OCS-induced growth would not be problematical.

To the contrary, 10,000 additional persons in Northampton County, Virginia, could be disastrous. Such an increase would be 67 percent of the county's present population. The infrastructure problems of overcrowding of schools, over utilization of sewage and water systems, traffic congestion, etc. could be monumental, especially since the tax base of the county is so limited. Front-end monies may be necessary in order to plan and implement the facilities needed to accommodate such increases; the unusually long lead times would have to be minimized. In terms of housing, for every three dwelling units in the county, two more may have to be built. Sewage and water demand would almost double, and government overhead could increase tremendously.

Noncapital-type expenditures in the public service area would show pronounced increases. None of these affects can be quantified without an in-depth analysis of the capabilities and limitations of the existing systems, however.

There could be pronounced socio-cultural effects in an area such as Northampton County, Virginia. It is a rural county with a comparatively low median income where over 50 percent of the population consists of minority members and 14 percent of the population is over 65. Prices in the county could increase astronomically due to the availability of money from the influx of persons who would have much higher incomes than the present population. In the existing employment sectors of the county, there could be disruption as the present employees are drawn to OCS-related work due to the higher wages. The "pace" of life could increase causing certain emotional impacts upon individuals. The cultural and moral persuasion of the county could be severely altered by the encroachment of urban values and lifestyles upon rural communities. Tensions between the newcomers and the minority and elderly members of the population could occur. However, it must be noted that it is considered very unlikely that OCS-related primary industrial development, occurring as a result of the proposed sale, would take place as far south as Northampton County, Virginia. It is anticipated that most

facilities would be located further north (e.g., New Jersey shoreline counties, New York harbor area). If development were to occur in the more southern portion of the Mid-Atlantic region it would probably be very limited in nature.

New York and Northampton both epitomize extremes within the region. Impacts felt within affected counties would lie somewhat within that continuum to the degree they are more similar to New York (e.g., Monmouth) than to Northampton (e.g., Cape May). Where it would actually lie within that continuum would be dependent upon the social, cultural, and economic nature of the area, its population size, infrastructure limitations, and the magnitude of the incoming population.

No degree of exactitude can be exercised in making predictions as to the magnitude of population and infrastructure impacts or precisely where they will take place if the proposed action takes place. Much of what may happen onshore will be determined by constraints placed upon OCS-related industry by State, county, and municipal controls. Facilitating the smooth accommodation of the OCS-induced population would greatly depend upon a timely, coordinated comprehensive effort toward intergovernmental and private sector planning.

d. Land Use Impacts

Table III-33 indicates acreage and locational requirements for facilities expected to result from this sale. A total of 160 to

Table III-33. Estimated Land Use Requirements of Individual OCS Related Facilities[1]

| Facility | | Locational Requirements |
|---|---|---|
| Onshore Operations Base[2] (Includes helicopter pads, warehouse space, small office and dockage) | 50.0 | Inland water docksite with ocean access, Atlantic shoreline not necessary; dockside able to accommodate drafts to 15 feet; industrial zoning. |
| Pipeline Shore Terminal (including storage facilities) | 40.0 | Rural area desirable; highway access. |
| Gas Processing Plant | 20.0 | Rural area desirable; highway and rail access. |
| Onshore Office | -- | Rental space; metropolitan area. |
| Mud Supplier | 4.0 | Inland water docksite with ocean access; industrial zoning. |
| Cement Company | 5.0 | Inland water docksite with ocean access; highway and rail access; industrial zoning. |
| Wireline Company | 6.0 | Industrial zoning; highway access. |
| Gas Lift Company | 0.5 | Industrial zoning; highway access. |
| Logging and Perforating Company | 4.0 | Industrial zoning; highway access. |
| Rental Tool Company | 3.5 | Industrial zoning; highway access. |
| Wellhead Equipment Company | 1.5 | Industrial zoning; highway access. |
| Machine Shop | 1.0 | Industrial zoning; highway access. |
| Trucking Firm | 5.0 | Industrial zoning; highway access. |
| Supply Store | 2.0 | Industrial zoning; highway access. |
| Downhole Equipment Company | 2.0 | Industrial zoning; highway access. |
| Diving Service | 0.5 | Industrial zoning; highway access. |

[1]Derived from information from the Offshore Operators Committee, an industry association, with the exception of acreage requirements for gas processing plants, which is from Resource Planning Associates, reported in CEQ's Oil and Gas--An Environmental Assessment.

[2]Assumes cooperative ventures between lessees. If this does not occur, additional smaller facilities would be required.

645 acres could be required regionwide for OCS-related facility development. Of this acreage, between 70 and 265 acres might be required in coastal areas. However, only operations bases and a few small service companies, which require docking facilities, would need to be located in the shoreline zone itself. While pipeline pumping stations need to be located in coastal areas, the storage facilities do not have to be located in coastal areas, but could be located inland from the pumping stations. Storage facilities are, however, normally located adjacent to the pumping stations.

As previously indicated, (III.D.1.a), it is anticipated that operations bases and pipeline terminals are most likely to be developed in New Jersey or Delaware, or in the case of operations bases, possibly the New York and New Jersey Port area. The New York and New Jersey port area, parts of Monmouth County, and inland parts of Cumberland County have areas of industrial buildup. However, the south New Jersey shore counties and Sussex County, Delaware, do not have concentrations of industrial build up. Isolated industrial uses and/or industrial zoning are found in these counties, however.

If required onshore bases or oil storage terminals are located in areas where industrial land uses and vacant parcels of suitable industrially-zoned land exist, no adverse land use pattern changes should result. Similarly, if those developments should take place in areas where

no industrial bases presently exist, but where developable land is available and such development is considered compatible, impacts would probably be positive. Adverse impacts to land use patterns could occur if such facilities were to be allowed in areas where industrialization or industrial expansion are not compatible.

Gas processing plants do not require coastal locations. They may be near or inland from pipeline terminals if gas and oil pipelines share corridors, in which case they would probably be located in New Jersey coastal counties or Delaware. A gas pipeline to northern Maryland might also be possible. Gas processing plants occupy relatively small sites and locational constraints are minimal. They could be placed in existing industrialized areas or in rural areas if local regulations allowed. Siting these plants in industrial areas near population centers could result in the need for incoming gas lines, as well as outgoing lines, to be odorized. The Department of Transportation, Materials Transportation Bureau issued new regulations Amendment 192-21, Docket No. OPS-241, Federal Register, Vol. 40, No. 91, May 9, 1975) requiring odorization of transmission lines by class location, the class being determined by the population in the area. The expense incurred in this process may account for rural locations desired by industry. While the influx of gas processing in the Mid-Atlantic region may lead to very minimal increases in petrochemical activities in the region, increases are expected in existing areas of petrochemical activity. As a consequence, it is not anticipated

that gas processing plants will lead to development of associated petrochemical plants, (as indicated in the economic analysis, subsection b. above). Therefore, the siting of gas processing plants is not expected to lead directly to other industrial uses. However, to the extent that any industrial facility placed in a previously unindustrialized locality can lead to adjacent industrial land uses, gas processing facilities in such an area could stimulate adjacent industrial uses. In addition, gas processing plants contribute to air quality degradation. For a discussion of this potential impact, see Section III.D.2.f. As previously indicated, gas processing plants are most likely to be located in New Jersey and possibly Delaware or Maryland. Because of the flexibility of their location, they could be placed in either rural or industrial areas, as ample suitable areas of both types exist in the three States.

Meeting these requirements for oil and gas related facilities without environmental degradation could be a problem in particular areas because of the abundance of wetlands along the coastal zone. If unregulated, the improper siting of these facilities might result in the use of up to about 250 acres of wetlands or other areas unsuitable for industrial or commercial use.

In an area like Accomack County, Virginia, where no zoning regulations are in force and where no state law specific to coastal facility siting exists, it is possible that industrial or commercial land uses associated with proposed oil and gas operations could develop which would be inconsistent with existing rural land uses in the surrounding area. Where siting and zoning authorities are exercised on a local municipal basis, decisions to site facilities in one municipality could be made which would be adverse to the desires of an adjoining community. For example, a gas processing plant might be allowed to locate in one coastal community in close proximity to a second home and recreation area of another community and be considered undesirable by the second community because of aesthetic reasons, air quality degradation or other reasons. However, siting of such a facility in a coastal area in Maryland, New Jersey, and Delaware (where all primary facility development is anticipated to occur) would be subject to state approval as well, and the interests of both communities might be taken into consideration by the state. In New York and Virginia, where no coastal area facility siting regulations exist at the state level, siting decisions might be made which would adversely affect an adjoining jurisdiction through secondary impacts or because the facility might be inconsistent with neighboring land use.

Pipeline corridors on land could have adverse impacts if not properly planned for and regulated. If placed across suitable areas, disturbance from burial would be temporary in nature. If placed

across wetland areas, areas subject to erosion, with high water tables, poor drainage, or excess slopes, natural processes could be disrupted and/or the pipelines could be exposed. However, these conditions might also constitute engineering problems for the laying of pipeline. These engineering problems could prevent pipeline corridors in such areas, or make alternate routes more attractive economically.

A rough estimate of the width of land disturbed by pipeline would be 50 to 60 feet disturbed by equipment and a band of perhaps 30 to 40 feet of soil and vegetation removal. (A description of onshore pipelaying methods may be found in Appendix 4).

If placed along existing transportation rights-of-way such as highway corridors, used or abandoned railroad rights-of-way or other utility corridors, the long term impact of a pipeline corridor would be minimal--it would be consistent with the existing use of the land. If placed entirely in new corridors, a pipeline would probably traverse many land uses and a swath up to 50 feet wide would need to be maintained free of trees or shrubs to permit maintenance vehicle access and to permit surveillance for leakage. Multiple use of the corridor might be made (such as a trail) but disruption and/or removal from other uses could also occur.

No estimates of onshore acreage utilized by pipelines can presently be made. Onshore pipelines for oil (2-4) will be required from landfall sites to existing refineries. Onshore gas pipelines (1-4) will

be required from landfalls, to processing plants, and on to existing transmission systems. Therefore, the amount of pipeline mileage will be dependent, not only on the numbers of pipelines, but landfall locations and location of processing plants relative to landfall and the existing transmission lines. No meaningful estimate can be made at this time. However, maintaining a 50 foot swath of land vacant would require about 6 acres per mile of pipeline.

Secondary Land Use Impacts

In the region there is available acreage to meet cumulative land requirements of increases population and induced development. For example, Resource Planning Associates, for its report to CEQ (in Oil and Gas--An Environmental Assessment) conducted a spatial analysis of the Delaware River region. The region was defined as the belt of counties stretching from the New Jersey suburbs of New York to Wilmington, Delaware, including the Philadelphia Standard Metropolitan Statistical Area. After removing developed land and land unsuitable for development because of environmental or locational constraints, they concluded that over 1.8 million acres of developable land exists in the Delaware River region alone. If all of the maximum expected population increase in the region were to move into new housing units, assuming quarter acre lots, total residential acreage required would be 1750 acres. Since the largest population increase on a county level is not

expected to exceed 10,000 persons, using the same assumptions, the maximum requirement for residential acreage in one county would be about 1300 acres. In rural counties where lot sizes are generally smaller, the acreage figure would decrease accordingly; in urban areas it would likewise decrease due to smaller lot sizes. The preceding subsection discussed possible housing impacts in more detail. As largest population impacts are anticipated to occur in counties which are not densely populated or heavily industrialized, the greatest demand for induced land requirement could occur in areas which generally have the most undeveloped land.

While no projection of amounts of required land has been calculated, additional commercial acreage within the region would be needed, as indicated by the growth shown in retail sales (Economic Impact, subsection b. above). Also required would be additional land for highway or road construction; however, it is not known whether stimulated construction would be in the form of expansion of existing highways or in new highways in new corridors.

Some manufacturing activity, particularly iron and steel, and petrochemical industries may be induced if the proposed sale results in oil discoveries. (Economic Impact subsection b. above.) However, very minimal increases in petrochemical activity would occur; no new facilities are anticipated to be built, but rather expansions of existing plants and higher capacity utilization could occur. Induced increases in industrial

activity are anticipated to be stimulated in existing industrialized areas, so that, particularly if adequate land use controls are enforced, siting of these industries should not be a major problem.

The economic analysis indicates one exception to this pattern. It indicates that stimulation of some machine and miscellaneous manufacturing might occur in Cape May County, New Jersey, if OCS-related facilities were to be located there. No activity of this type presently exists in Cape May County, which is, relative to other New Jersey counties, removed from areas of industrial activity. It is possible that other rural, somewhat isolated counties such as Northhampton County, Virginia, could receive similar induced industrial activity as a result of a combination of several OCS-related activities being located in them. In Cape May County, where there is a small proportion of land suitable for industrial uses, siting of new industries could cause adverse environmental effects if not properly controlled. If industries are allowed to locate in areas without existing industry, land use patterns would change. Whether those changes would be adverse would depend on how land use controls are exerted and whether changes are desired by the communities affected.

Induced infrastructure requirements, from a regional perspective, appear to be minimal, as indicated in subsection c. above, with resulting minimal land use implications. The economic analysis indicates that construction in these sectors is not expected to

be immediately stimulated by influxes of population, but rather to respond once permanent population levels become apparent.

Within a specific area, however, land use impacts could be substantial if they are not planned for and regulated. If facilities and several thousand people are drawn to one county and tend to concentrate in one or a few locales, accommodation in suitable areas could be a problem. For example,many of the shore communities along New Jersey's coast are built on barrier islands with little land left for development. Development in many of these communities has begun to encroach on wetlands, as it spreads to adjoining mainland areas. Strip commercial development along coast highways has also taken place. In rural areas such as the Delmarva Peninsula, growth might be dispersed, following existing trends, and while the result would be less visible, such land use is least economic in provision of services. Similar encroachment on agricultural lands could also result in adverse impacts.

Summary

Adequate suitable land for development necessitated by OCS activities and induced population increases probably exists in all counties. However, rapid, uncontrolled growth could result in patterns of growth which are not desired by the communities and development could encroach upon wetlands or other areas for which agricultural, recreation or other uses are thought to be more appropriate. The extent to which this occurs will be a function of the types of controls evoked by state and local governmental

jurisdictions. The general location of many of the facilities which would be required onshore as a result of the proposed sale would be a function of where pipelines are allowed to come ashore. As pipelines locations within the states' three mile limit offshore, as well as onshore, would be a matter of state jurisdiction, the general location of these OCS-related activities could be directed by state actions, in addition to specific siting control which would be exercised by state and/or local controls.

However, despite the fact that in most cases there are state and/or local regulatory authorities which could be exercised to control the various aspects of OCS-related onshore development, it should be pointed out that these controls have not always been wisely used. Most are non-affirmative and are reactive to individual development proposals, often judged on a case-by-case basis, rather than as they relate to overall planning and environmental goals. For example, Cape May County, in its supplementary testimony concerning the DES for Proposed OCS Lease Sale No. 40, stated:

> It is not unusual, due to the tax structure of New Jersey and the need for municipal ratables, for localities to make land use decisions that are bad for the environment, their neighbors and the region as a whole. The tax structure of localities are dominated by the need for ratables and zoning decisions are often made in the face of considerable pressure of local, physical needs...Historically, and understandably, zoning decisions at the local level often express a considerable disregard and discern for long-term environmental, economic and social needs.

The Coastal Zone Management Act, on the other hand, is designed to be an affirmative program for directing land and water use in the coastal zone. The Mid-Atlantic states are all scheduled to receive implementation grants in 1977, previous to the development of most of the facilities anticipated as a result of this sale. In Chapter VIII, Section B.1. an alternative to delay the proposed sale pending implementation of coastal zone management plans is considered.

e. Impact on Recreation and Tourism

Recreation and tourism essentially address the same realm of activities but from different perspectives--one from a sociological and the other from an economic viewpoint. This section will discuss which OCS oil and gas development associated activities will impact recreation and tourism resources and how those resources might be affected qualitatively and, where possible, quantitatively. Potential impacts resulting from the proposed sale exist in two major categories: 1) oil spills and 2) onshore development associated with OCS oil and gas activities.

Oil spill-induced impacts could result from:

1. The soiling of beaches by major oil spills emanating from drill site blowouts
2. The soiling of beaches by major oil spills emanating from a nearshore pipeline break or spill from a transport vessel
3. Oil seepage from minor leaks from pipelines that are buried beneath beaches

Onshore facility-induced impacts could result from:

1. The disruption of beach areas caused by pipeline laying
2. The competition for land caused by construction of facilities
3. Degradation of the aesthetic environment conducive to recreation and tourism

It has been assumed, for purposes of this discussion, that if an oil beaching occurs it will impact recreation/tourism area(s). In the region as a whole, approximately half of the shore areas are used for public and private recreation purposes (see Section II G.1.d.). Along the Atlantic coasts of Maryland, Delaware and New Jersey, however, virtually all of the shore is used for recreation/tourism purposes in one form or another. As previously discussed, oil spills emanating from the area of the proposed lease tracts could, if they reached shore, beach anywhere along the shore of these states. It can be assumed, therefore, that such a beaching occurrence would impact recreation/tourism areas. Additionally, it seems likely that, if quantities of oil sufficient to justify pipeline(s) are discovered in the proposed leasing area, oil pipelines will probably be directed to terminals along the coasts of New Jersey or possibly Delaware. In either event, near shore spills from any pipelines so located would probably beach on the shores of one of the three aforementioned states resulting in impacts to recreation/tourism interests.

The soiling of prime recreational beaches by a major spill would foreclose their use for recreational purposes at least for the duration of the oil's continuous beaching and any subsequent clean-up period that would be necessary. If a beach area is relatively accessible, clean-up can be effectuated in a matter of days through

the mechanical removal of oil soaked sand. Depending on the pre-existing condition of the beach (i.e., degree of erosion). efforts might have to be made to replenish the sand that had been removed by clean-up operations. This could take an extended period of time (possibly months) depending on the availability of sand and/or the requirement to obtain a permit to remove sand from submerged lands for replenishment purposes. The timeframe of curtailed uses could be extended beyond the period necessary for clean-up and replenishment by the adverse publicity associated with the beaching. The size, seasonality and beaching location of a spill are other significant factors which influence the magnitude of the recreation opportunities that will be curtailed. These factors are discussed in more detail below.

Drill Site Spills

The probability of an oil spill occurring at the drill site locations and its subsequent beaching along the Mid-Atlantic shoreline is discussed in Section III.A. According to the best available information, the probabilities of such occurrences are minimal. The highest probabilities that spills will reach shore occur during the spring season (Section III.A.4.). The characteristic sea state during the spring should enable successful containment and clean-up activities (assuming booms effective in five-foot seas) to be undertaken about 80 percent of the time, assuming adequate contingency

plans had been made and are implemented in a timely manner. Moreover, an actual beaching occurrence during the early spring would allow a sufficient time period for successful clean-up operations to be effectuated prior to the initiation of the prime recreational season. A late spring beaching occurrence, localized in effect, could receive a sufficient amount of publicity to discourage visitation at that locale for the remainder of the peak season. Generally, however, the likelihood of spills emanating from offshore drilling sites resulting in a beaching occurrence that would adversely affect recreation and tourism interests is minimal. It seems reasonable to assume, however, that the minimal probabilities that do exist might be increased by the discovery of greater quantities of recoverable resources which could possibly result in a corresponding increase in the number of wells drilled.

Pipeline Spills

The studies referenced in the discussion of oil trajectory probabilities (Section III.A.4) indicate that the closer to shore an oil spill's point source is, the greater is its probability of beaching. The discussion in Section III.A.2. indicates that the probability of pipeline related spills occurring are greater than drilling related spills. Consequently, the greatest threat to recreation and tourism comes from spills emanating from nearshore pipeline breaks. This type of beaching occurrence could happen during any season. Increased quantitites of recoverable resources might result

in the need for additional pipeline capacity. Capacity could be enlarged either through laying more pipelines or by using larger diameter pipelines. Increasing the number of pipelines could raise the probability of spills occurring whereas increasing pipeline diameters could result in more widespread effects of a spill if one should occur. In either case, the discovery of larger quantities of oil could affect both spill probabilities and the magnitude of potential impacts.

## Seasonality of Impacts

The following discussion focuses on the impacts associated with a localized beaching occurrence during the different seasons. Obviously, the impacts on both recreation and tourism will vary by type and magnitude depending on the specific shoreline affected. This holds true not only because of the different purposes for which the resources are used, but also because of the numbers of people that use them. The tourist resorts of Atlantic City, the two Ocean Cities and Rehoboth Beach, to name just a few, would be affected quite differently, qualitatively and quantitatively, than the second home shore communities along the Atlantic coast of Delaware, northern New Jersey and Long Island. The Brigantine and Chincoteague National Wildlife Refuges would be affected differently from either of the above types of areas. The impacts on even the same type of area (resource use) could differ significantly given its location. The quantitative, and probably qualitative, impacts

resulting from oil beaching at New Jersey's Island Beach State Park could differ markedly from a similar occurrence at New York's Jones Beach State Park. In this discussion consequently, seasonal impacts will be analyzed generally. A more detail discussion of the types and magnitudes of impacts that might be sustained in a given locale occurs in the latter part of this section. Additionally, the reader can refer to Section II.G.1.e. for a description of the region's more significant coastal recreation facilities and uses.

Water-oriented recreation/tourism activity in the Mid-Atlantic coastal areas occurs predominantly during the half of the year from May through October with the greatest use concentration being from Memorial Day through Labor Day[1]. A spill during either the fall or winter would not result in significant impacts on recreation and tourism[2] for several reasons. Additionally, an oil beaching occurrence during this time of year would not have a significant impact on the succeeding summer season's activity, assuming timely and effective clean-up activities as well as sufficient positive publicity on these activities.

Impacts on waterfowling would be greatest, however, from a fall spill occurrence which directly impacts migratory bird areas. A major spill could result in significant mortality rates among

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[1]Sport fishing use would not be as heavily concentrated in the summer months as other activities, and waterfowling, because of statutory controls as well as migratory habits, occurs during the fall/winter period.

[2]With the exception of waterfowling, which is discussed separately below.

migratory waterfowl populations. This population decrease could seriously curtail participation in the localized area affected. Some hunters would undoubtedly seek alternative areas but others would forego participation during that season. The magnitude of the short-term impact will depend on the number of birds killed and the significance, for waterfowling purposes, of the impact locale.

Conceivably, a major spill in a wildlife refuge, where waterfowling is not permitted, could cause a large bird kill and yet not result in a diminution of waterfowling opportunities during that particular hunting period. Waterfowling is allowed, however, in almost all of the Federal and State wildlife management areas depicted on Visual #1.

Pinpointing specific areas which may sustain decreased waterfowling opportunities because of an oil spill is difficult. Almost one-third of a million waterfowling hunter days took place in New Jersey and Delaware in 1974 but less than 10,000 of these activity days occurred at the coastal National Wildlife Management Refuges depicted on Visual #1. Undoubtedly, most of the waterfowling activity occurred at State wildlife management areas and/or on privately owned lands. Most of the State areas are located along the shores of Delaware Bay and, consequently might not sustain serious impacts from either drillsite or pipeline oil spills. A tanker spill in the Delaware

Bay, however, could provide a serious threat to these areas. Most of the private wetlands along the Atlantic Coast that provide waterfowling sites could be protected from the impacts of an oil spill, except from nearby pipelines because of their location behind major stretches of barrier beach.

An oil spill which results in a major bird kill could also have a long-term impact on waterfowling. Significant mortality rates will reduce the number of birds during the subsequent nesting season. There is also evidence that the less than toxic levels of oil that is ingested by surviving waterfowl has an adverse effect on hatching rates. These factors combined may result in a significant decrease in bird populations in the succeeding year. The impact on bird populations in succeeding years would not be localized but would be felt regionally. There are a number of other factors which can also affect the size of a succeeding year's bird population. Consequently, there is no clear relationship between the size of an oil spill-induced bird kill and the decreases in bird populations that may be detected in specific locales in the succeeding year. Essentially then, long-term adverse impacts on waterfowling opportunities could be caused by a large bird kill associated with an oil spill, but the pinpointing of areas where it will be felt, and in what magnitude, is not calculable.

A beaching occurrence in the summer season will undoubtedly curtail recreation participation in that locale for the remainder of the summer season. Use will be curtailed during the time of the spill and clean-up operations. Additionally, the adverse publicity associated with the beaching could discourage participation for whatever portion of the summer season remained after clean-up operations had been completed. The magnitude of the impact would be a factor of the time it occurred within the season. Obviously, the later in the season, the smaller would be the short-term impact. Additionally, a late season beaching occurrence would lessen the likelihood of there being significant long-term impacts (impacts which extend over more than one recreation/tourism season).

Long-term impacts from an early season summer beaching are a factor of the structure of the tourism economy and the nature of the formulation of people's recreating patterns. Many recreation/tourist operators are small, marginally profitable enterprises. The loss of most or all of a summer season's income could have not only the obvious short-term impacts of loss of jobs and income, but also may undermine the viability of the enterprises for succeeding summer seasons. Moreover, people who vacation and/or periodically recreate in an alternative locale during that summer season, may form preference patterns which would result in their avoidance of the impacted locale in subsequent years even though the area was once again suitable for use.

With a spill being localized, and given the tendency of people to select nearby, similarly situated areas as alternatives, the net loss of participation on a regional and even county basis might be only marginal in areas where several other nearby beaches are available. Such effects were observed after the 1969 Santa Barbara Channel oil spill (Marine Science Institute, University of California-Santa Barbara, 1970). The localized impact, however, could be severe and may take several seasons for participation to recover to pre-spill levels. Short-term localized crowding may occur at alternative areas, particularly on weekends. Crowding at most popular shore areas already exists on summer weekends and this induced increase could be marginal and consequently not readily noticeable.

A spring beaching occurrence could potentially have impacts similar to those of a summer occurrence. In some respects, a spring occurrence might have even more serious impacts than a summer spill. Many people make plans and reservations for their summer weekend and vacation activities during the spring. Major adverse publicity associated with a beaching occurrence at this time could cause people to plan to visit alternative areas. This would effectively preclude significant portions of potential participation for the entire summer season. The long as well as short-term implications of this major curtailment in participation have been previously mentioned. Additionally, these impacts could potentially be felt on a widespread as well as localized basis. This could result because, given the additional time to consider alternatives, people

may decide to participate in geographically more distant locales. This could result in net losses in participation at county and regional, as well as local levels. Assuming, however, that successful cleanup is rapidly effectuated, sufficient positive publicity could be generated thereby limiting both the scope and duration of potential impacts.

Minor Pipeline Leaks

Oil seepage from minor leaks in pipelines that are buried beneath beaches could result in localized short-term impacts. Pipelines are engineered so that significant leaks can be readily detected and the problem corrected. Very minor leaks can go undetected for some period of time, particularly where buried onshore. Oil leaking from a pipeline buried in the swash area of a beach would move towards the beach surface because of specific gravity differences between saline groundwater and oil. The beach sand would be contaminated by the oil. Corrective action would require removal of the contaminated sand, pipeline repairs and sand replenishment. This could be accomplished in a matter of a few weeks. The area impacted would be small because the pipeline corridor could be expected to be less than 50 feet wide. The leak could be detected shortly after surfacing because of the periodic beach patrols of pipeline corridors that may be undertaken. The magnitude of the short-term impact on recreational opportunities

will be determined by the quantity of use that the area sustains. Since important recreational beaches could be avoided in the identification of pipeline corridors, the quantitative impact on recreation opportunities can be minimized. The impact that might occur would be a short-term (weeks or months) dislocation of participation.

Pipeline Construction

Pipelines which cross beaches will probably require burying thereby resulting in a short-term physical disruption. From a recreational standpoint, use of the beach will be foreclosed during the pipeline laying operation. This will be a relatively short timeframe and will be restricted to a narrow corridor. The corridors could be identified so as to avoid important recreational beaches. Additionally, the pipeline laying operation could be undertaken during the time of the year when beach use is virtually nonexistent. Consequently, pipeline laying will probably have, at the most, only short-term, negligible impact on recreation opportunities in a very specific locale.

Onshore Facilities

The construction of onshore support facilities could compete for shoreline land with recreational interests. Only one type of major facility directly associated with oil and gas drilling, operations bases, requires shoreline siting. The others

can be accommodated somewhat inland. Industrially zoned land already exists in locations logically suited for operations bases. These bases presumably do not presently compete with recreation interests and there are no clearly identifiable factors associated with operations bases that would introduce such land competition. Consequently, there is no discernible evidence that measurable land competition with recreation (other than what normally occurs in any developing area) would necessarily be introduced by the construction of onshore support facilities resulting from the proposal.

The existing environmental quality of the Mid-Atlantic coastal counties is very conducive to recreation and tourism activity. The impacts of OCS-related onshore development on water quality and open spaces will be minimal. As Section III.D.1.d. indicates, land use requirements generated by OCS-associated development will be minimal, particularly in light of the availability of adequate land resources. The major area of sensitivity would be the shore but only very limited portions of it might be required, as discussed above. The impacts on water quality, (other than from an oil spill) as discussed in Section III.D.2.e., are anticipated to be negligible.

The major recreation-related aesthetic concern associated with onshore development comes from the operation of gas processing plants. Section III.D.2.f. indicates that gas processing plants

could emit significant quantities of sulfur dioxide which has a very unpleasant odor. (Our concern here is with the aesthetic impact of sulfur dioxide. Other aspects of this and other potential emissions are discussed in Section III.D.2.f.). The resultant degradation in the area's air quality could discourage recreation and tourism participation. If such an impact were to occur, its effects, although quantitatively incalculable, would be long-term in duration lasting at least the anticipated 25-year lifetime of OCS gas production. Even in the absence of a quantitative impact, recreation participation which continued in the areas would be affected qualitatively.

In summary, gas processing plants could produce emissions that would have adverse impacts, both quantitative and qualitative, on the aesthetic environment that provides the setting for recreation and tourism activities in the coastal areas. Such impacts would be long-term in duration. The technology exists, however, to restrict the quantity of these emissions. Additionally, it is not necessary that these plants be located in close proximity to shore areas where most of the recreation/tourism activity occurs. Consequently, these potential impacts could be effectively minimized.

Summary

To better understand possible impacts to recreation which may result from the proposal, a discussion of the most significant potential impact and resources it might affect follows. The greatest potential threat to recreation and tourism resources comes from an oil spill emanating from a nearshore pipeline

break. Since it is anticipated that pipeline landfalls will most likely be located on the Atlantic Coasts of New Jersey and/or Delaware, the recreation/tourism resources in this area could potentially sustain the greatest impacts. These impacts could be social (i.e. loss of recreational opportunities) and/or economic (i.e. loss of employment and income).

Opportunities might be curtailed at some Federal and State facilities. The use of Brigantine National Wildlife Refuge, for example, could be curtailed by a pipeline oil spill. Use of the Refuge, which had approximately 150,000 visitors in 1974, is oriented to passive enjoyment of the wildlife and natural setting of the area. Since only portions of the activities which take place there are oriented to the shoreline, physical curtailment might only be partial. However, additional use might be discouraged because of aesthetic impacts. Conceivably, recreation activity at the Sandy Hook portion of Gateway National Recreation Area or the Assateague Island National Seashore could be impacted particularly in the summer, by spills from pipelines with landfalls in northern New Jersey or southern Delaware, respectively. Those facilities sustain very heavy active recreation use (combined total in excess of two million visitors in 1974) and an oil spill impacting them would be of major consequence. There are also several State-administered recreation areas in New Jersey (Island Beach and Barnegat Light State Parks, North Brigantine and Cape May Wetlands Natural Areas) and in Delaware (Cape Henlopen

and Delaware Seashore State Parks, Assawoman Wildlife Area) that could be adversely affected by an oil spill. Together these areas accommodated over a million visitors in 1974 with the state parks providing the more active oriented recreation opportunities (i.e. beach use, swimming, fishing). Island Beach State Park alone accommodated over a half million visitors. An oil spill beaching on the shore of one of the state parks would result in the curtailment, at least temporarily, of significant amounts of beach oriented recreational activity at those sites. As discussed previously when considering seasonality of impacts, while a spill beaching at anytime would have an effect on tourism and recreation, the greatest effects would result from a spring or early summer beaching of oil. Loss of opportunities at the natural and wildlife areas would not be as large (as a percentage of an area's total visitation) because the activities taking place there are passive and tend to be more dispersed over the entire facility instead of being concentrated along the shoreline.

Most of the Atlantic Coastal beaches from Atlantic City south to Cape May are operated as public recreation areas by the local municipalities. Annually, these beaches provide millions of active beach oriented recreation opportunities. They also provide the main foundation for the tourism sector of the economies of Cape May and Atlantic Counties. As much as two-fifths of the employment in Cape May County

and one-fifth in Atlantic County may be generated by the tourism activity that is associated with coastal recreation use. In some of these coastal communities, such as Ocean City, Avalon and the Wildwoods, the percentage of employment that is tourism-generated is even greater.

Consequently, oil spills which would foreclose use of these beaches for any significant portion of time would have marked economic as well as social impacts. Similar adverse economic impacts could be caused in Ocean City, Maryland (where more than one-fifth of the county employment may be tourism generated) and to a lesser extent in the Rehoboth Beach, Delaware area. The economies of these locals are particularly susceptible to a major oil spill beaching. The extent of economic harm which may result from such an occurrence can not be calculated with any degree of specificity, however, because of the importance of the interplay of the factors which were previously discussed (i.e., spill size, duration, seasonality and locale).

f. Impact on Archeologic and Historic Sites

Onshore development resulting from this proposed sale could negatively affect archeologic and historic sites. The building of onshore bases, natural gas processing plants, and trenching for pipelines might destroy or disturb the undiscovered remains or artifacts of early Indian groups and colonial occupations. Oil spills from pipelines onshore could seep through the ground and coat artifacts, adversely affecting their value and usefulness.

The historic sites enumerated in subsection II. G. 1. h. could be affected by oil spills or the construction of onshore facilities. In both instances the impacts would be visual and not physical in nature. The beaching of oil adjacent to a historic site would have short-term impacts on the aesthetic quality of a site, assuming clean-up operations are rapidly effectuated. The laying of pipeline could also have short-term impacts on the aesthetic quality of a site. The adverse impacts to the aesthetic environment of a site caused by the construction of an onshore facility adjacent to that site could be long-term.

State environmental and regulatory agencies have responsibilities for pipeline siting approval and opportunities to review plans for onshore development related to offshore activities. See Section IV.A.1.b.; IV.E.1.&5.; and Appendix 11, OCS Order No. 7 for pertinent mitigating measures.

g. Solid Waste

Offshore

The proposed Mid-Atlantic OCS Orders require that all galley, paper, glass, metal and other wastes be returned to shore for disposal. Based on a figure of 4.5 lbs per person per day of solid waste [estimates range from 3.3 lb to 6 lb (Snyder, 1974, CEQ, 1974b)], the maximum expected tonnage generated offshore in the Mid-Atlantic as a result of the proposal during peak production years would be approximately 2000 tons per year (45 tons per week). This is equivalent to 10 percent of New York City's daily trash load or one or two day's waste loading for the new resource recovery units that should be operative by the 1980's in the larger port cities, e.g., New York and Baltimore. If all the waste were disposed of at one site, which is unlikely, the addition would represent an increase of less than one percent in the annual waste loads for the port cities and the more industrialized counties. For most other less industrialized or densely populated counties, it would represent a two to six percent increase. For the areas similar to Salem County, New Jersey, or Northampton County, Virginia, the increases would be approximately 20 percent. Section II.G.1.j. has listings of annual tonnages for the areas expected to be affected. At times other than peak production, the additional increases in annual waste loads would be smaller.

The other source of offshore solid waste resulting from this proposed activity would be that generated during an oil spill cleanup operation. This would include oil impregnated sand, synthetic tapes, foam, straw, chips, and so on. Figures for these tonnages would be dependent on individual spills and the particular area involved.[1] Though volumes are not computable at this time, the disposal of this type of waste could create problems for any solid waste management system because of both its volume and its characteristics. New Jersey has already designated solid waste disposal sites for this type of waste while other states have preferred to operate on an incident specific basis.

Onshore

Impacts on existing solid waste management systems as a result of the proposed sale are predicated on expected population changes and on a figure of six pounds per person per day (1.1 ton per person per year). This figure accounts for the various types of waste generated either directly or indirectly by each individual including residential, commercial, industrial, agricultural and so on. As has been shown in the discussion of population (Section II.D.1.c.), region-wide population increases of less than 0.1 percent are expected as a result of the proposed action. During peak production years in the early and mid-1980's, the maximum increases anticipated range from 5600 to 20,800 persons. This would be the equivalent of approximately 6160 to 22,880 tons per year

[1] A recent 385,000 gallon spill resulting from the collision of two tankers in the Delaware River near Paulsboro, New Jersey in February 1974, generated 17,000 cubic yards of oil-soaked debris. P. Elliot, personal communication, 1975.

additional load, an increase of less than 0.01 percent for the region as a whole (Section II.G.1.j.). During the years before and after peak production, the quantities generated would represent even smaller increases.

Increases in population for any one county during peak production are not expected to exceed 10,000 persons or, equivalently, 11,000 tons of solid waste per year. Assuming that all of this waste would be disposed of in one city or county a wide range of impacts could be expected.

In the larger cities, such as New York or Baltimore, or in the highly industrialized counties, such as Hudson or Middlesex, New Jersey, this would be equivalent to an increase of 0.1 to 2.5 percent in the annual solid waste load. As such, it would not require modification of the existing systems of collection and disposal. For two of the New Jersey coastal counties, Atlantic and Cape May, and in the Hampton Roads area of Virginia, this increase would represent an increment of 7 to 10 percent. Here again, the additional waste load would probably not require the development of new landfill sites or incinerators or, except for Atlantic or Cape May, require modification of existing vehicular collection and transportation systems. For most other counties in the Mid-Atlantic region, the increase would be approximately 20 to 30 percent of the existing annual load. This additional waste load

would require the development of new landfill sites or incinerators and, for less developed counties, the development of newer vehicular collection and transportation systems. In the remaining counties like Northumberland or Mathews, Virginia, an increase of this size would approximately double the present annual waste loads. Such increases would require the development of new sites or incinerators and new collection and transportation systems, including access roads.

All of the above-mentioned impacts are predicated on the expected waste load for peak production years and the assumption that the total would be disposed of in one city or county. Actual impacts are anticipated to be less severe since, at times other than peak production, the waste volume would be less than 11,000 tons and would probably be distributed over more than one area. These areas would probably be limited to New York, New Jersey, and Delaware. Because this peak production impact would only cover a few years, the affected counties may not develop the additional landfill sites or new transportation systems that would be required if the 1 to 30 percent increase in waste load was to be sustained.

h. Aesthetic Impacts

The aesthetic character of a given area is difficult to quantify or qualify, because value judgments are involved. Any value judgments made result not only from one's perception but also

from one's previous frame of reference. The unbroken expanse of the ocean's horizon may be pleasing to some, whereas others may value more highly the nighttime urban skyline. Consequently, this section discusses only those changes in the existing aesthetic environment of an area which, if generated by OCS development, might be regarded as degrading effects.

The only significant aesthetic impact resulting form offshore activities as a result of the proposed sale will be oil spill-induced. Drilling and production activities which may take place in the area of the proposed lease tracts will not be visible from shore because of the distances involved. Such activities would not even be observable by the overwhelming percentage of pleasure boaters either, because such boating activity tends to occur much closer to shore. The beaching of oil, whether from drill site or pipeline spills, will cause negative visual impacts limited to the areas affected and lasting until clean-up can be effectuated.

Aesthetic impacts could result from the placement of oil terminal/storage facilities, gas processing plants and pipelines. The placement of oil terminal/storage facilities and gas processing plants along beaches or in wetlands could have visually obtrusive effects. Generally, these effects would be localized but, if placed on or near an undeveloped shoreline in flat terrain, they could have more far-reaching impacts. Minor impacts could also occur in limited

areas due to noise pollution; for example, from use of helicopters and aircraft to support OCS-related offshore exploration and development drilling activities.

2. Impacts on the Natural Environment

a. Onshore Vegetation

Upland Vegetation

Upland vegetative communities (vegetative complexes and associated flora described in Section II.F.2.a.) are liable to be impacted from pipeline burials or construction of onshore facilities. Impacts upon them would primarily be their removal in the clearing process prior to construction and while dredging for the burial of pipelines. This would initiate a period of secondary succession in the immediate areas affected. These areas would be relatively small but the plant succession associated with them would continue for a long time. The principal vegetative covers in the storage areas would probably be grass for the covenience of working in close proximity to storage facilities.

Other aspects of onshore facilities can impact vegetation. They include maintenance disturbances, changes in air quality, and oil spills. Impacts due to changes in air quality are discussed in Section III.D.2.f. Impacts on vegetation due to pipeline and storage facility spills can occur. Herbaceous or small forms could receive the greatest impacts due to direct toxicity or smothering. Large forms or those not covered by oil are less likely to be impacted. On a long-term basis the possibility of impacts would probably continue at least as long as the various facilities are in usage, which would ultimately depend on the life of the proposed offshore fields.

## Wetlands

According to Boesch et al. (1974), salt marshes have generally proven to be resistant to various forms of pollution including that of oil. In previous cases they have suffered minimum damage. From studies in Louisiana, Mackin (1950a, 1950b) concluded that moderate dosages of oil were not excessively harmful to Distichilus spicata, Spartina alterniflora, and Batis sp., but continuous application of oil proved lethal. He also reported that oil can produce a "fertilizing" effect and stimulate growth.

Reports on marshes polluted by crude oil spills from Torrey Canyon (Stebbins, 1970), Chryssi P. Goulandris (Cowell, 1969), West Falmouth (Burns and Teal, 1973), and the Arrow (Thomas, 1973) have been made. They, along with Baker's (1971a) study, have shown that marsh plants can survive light to moderate oiling from a single dose. Reported effects include death of heavily oiled shoots followed by regrowth of shoots (Boesch et al., 1974). Multiple dosages cause considerably more damage.

To a large extent, the amount of damage to marsh plants seems to be related to the type and amount of oil as well as the plant species and time of year (Boesch et al., 1974). They report that weathered oil, which has lost the aromatic fractions, is less toxic than fresh oil or light fuel oils (Section III.A.3). While the lighter fractions are directly lethal, heavy oils can smother plants. Stebbins (1970)

attributed the death of plants after the Torrey Canyon crude oil spill to be due to an impermeable barrier to gas exchange rather than direct poisoning. It is reported that the lack of gas exchange can also lower oxygen levels in soils (Baker, 1971b).

Boesch et al. (1974) summarizes Baker (1970) who reported the effects of direct contact of oil on plants. He reports that hydrocarbons can penetrate into plants via the stomata (pores). After getting into the plant, oil can travel within intercellular spaces. Oil consequently reduces transpiration and translocation probably by either blocking these spaces or stomata. Metabolic mechanisms can also be disrupted and change respiration rates.

Impact of oil on marsh plant species can depend on time of year. It would probably have the greatest impact during the growing season as compared to other times. It may influence flowering, seed development, and vegetative reproduction. Annual or herbaceous species may suffer more than perennials as they cannot survive by regeneration from roots (Boesch et al., 1974).

Mackin (1950b) and Baker (1971c) have noted the fertilizing effect of oil on marsh plants. Possible causes for stimulation include the increased water retention of oiled soil, release of nutrients from oil-killed animals, plant nutrients or regulators in oil, and nitrogen fixation by oil degrading micro-organisms (Boesch et. al., 1974).

Previous spills have demonstrated that many spills affecting marshes do not only injure the vegetative component but faunal ones as well; they are reported in a previous section. Burns and Teal (1971) after analyzing marsh communities one year after the West Falmouth spill reported that all organisms at the spill site were contaminated. They included two algal species; Salicornia and Spartina alterniflora; a mussel; the killifish Fundulus; the American eel; and the herring gull. Burns and Teal also reported oil penetration 70 cm in marsh sediment and that although oil was incorporated by organisms, there was no evidence of food chain magnification.

In the event of a pipeline oil spill in a fresh water marsh, aside from effects to vegetation and wildlife, the possibility exists that very local ground water supplies could be contaminated (fresh water marshes serve as recharge areas for some ground water aquifers).

Chronic pollution has been discovered to have harmful effects on marshes. Baker (1971a) concluded that more than two or three fresh oil spills a year or one or two per year with weathered oil could reduce marsh grasses. A marsh near a refinery effluent was reported by Baker (1971d) to be completely denuded by chronic low-level pollution. It is probable that the grasses were killed by being continually coated with thin oil films.

The loss of vegetation resulted in erosion of the marsh bank (Boesch et al., 1974). Runoff can occur causing turbidities which can ultimately lower oxygen levels in water.

Activities associated with pipeline burials, construction of on-shore facilities, and possible clean-up equipment can impact marsh communities if they occur within them. They can be expected to be destroyed within all burial and construction sites due to the clearing of vegetation. Areas adjacent to construction sites can also be expected to be impacted due to equipment movement and associated activities but on a more temporary basis. Water flow within a marsh may be altered significantly. If salt water intrusion follows, the recovery time of the marsh will be lengthened. Once altered, marsh habitats often take a long time to recover if recovery is possible. Herbaceous and vegetative reproducing forms will probably recover in a shorter period of time than the associated fauna. As previously mentioned, pipeline routes are anticipated off New Jersey and to a lesser extent, Maryland and Delaware. Drainage of wetlands for providing coastal facility siting is not anticipated because of the availability of other sites, the expense and practicability associated with this sort of project, and the adverse impacts on the community which can result; and existing state and local legislation.

In summary, we conclude the following:

Oil spills - Chronic oil pollution of salt marshes has been demonstrated to have the greatest adverse impacts with

possible denudation. The effects of a single oil spill depend, to a large extent, on various factors as amount and type of oil, time of year, and plant species involved. It is believed that marsh vegetation, although sensitive to both light fractions and less toxic heavy oils, can survive light to moderate oilings and survive. Oil in lesser amounts may have a fertilizing effect on the vegetation. Marsh communities most susceptible to oil spills could be nearshore ones along pipeline or tanker routes. Marsh communities and refuge areas in Coastal New Jersey, and to a lesser extent those off the Delaware, Maryland and Virginia coasts would be vulnerable to spills resulting from pipelines. Those marsh communities adjacent to tanker routes into New York Harbor and Delaware Bay might be especially vulnerable to tanker spills if tankers have to be used.(Section III. D.1.a.). Offshore spills from tracts in this proposed sale will not likely affect marsh areas because of the minimal expected probabilities of offshore spills reaching shore and protection afforded marshes by barrier islands. However, if spills should occur in enclosed estuary/ intertidal areas, the impacts would be more severe.

Onshore activities - Activities associated with pipeline burials and construction of onshore facilities could impact the vegetation if construction occurs within these areas. The greatest impact could result from clearing and disturbances associated with construction. Recovery time depends on various factors as length of time the facilities is used and extent of damage to the habitat. However, if facilities, especially pipelines, are constructed in wetland area, more severe impacts of disruption of drainage patterns, erosion and salt water intrusion could occur.

b. Beaches

Adverse impacts on beaches as a result of this proposed sale would be caused by possible oil spills, pipeline emplacement, and construction activities. Since approximately 80 percent of the Mid-Atlantic shoreline considered by this statement is beach the probability of a spill which reaches shore affecting a sand beach is also about 80 percent. Depending on the nature of the spill and its release point (Section III.A.2.), the spill which reaches shore could range from tar balls or patches or even heavy coatings (most likely in cases of pipeline or tanker spills). If any beach area is contaminated by oil, an undetermined amount of wildlife habitat will be damaged. Heavy coatings of oil which seep into the sand or are buried by either man or natural causes may not totally degrade if it is removed from zones of microbial activity. This oil could be returned to the surface at a later date causing a nuisance to recreational use.[1] It is not anticipated that any one Mid-Atlantic beach would be more greatly impacted (on an environmental basis) by an oil spill than any other Mid-Atlantic beach.

If mechanical means are employed in cleanup operations (bulldozers, front end loaders, and other earth moving equipment) as has been done

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[1] Impact of oil spills or construction on recreational beaches is discussed in Section III.D.1.e.

in previous spills in the United States, then shoreline equilibrium may be upset by beach removal. Excessive removal of beach sand can lead to erosional problems unless enough materials are available to replace it.

A pipeline which crosses a beach will probably be buried, causing short term damage in a 30-50 ft (10-16 m) wide swath. All vegetation and nonmotile animals will be killed in the path of the pipeline. Some slight damage may also be rendered to vegetation and beaches in adjacent areas by machinery used in the operation. Return of the shoreline to equilibrium will take only a few tidal cycles in the lower swash zone. However, beach ridges may take up to several years to return to equilibrium depending on storm intensities. The dune line may also take up to several years to recover unless it is rebuilt after the pipeline is emplaced.

We do not anticipate construction activities (other than pipelines) to take place in beach areas primarily because of the cost of beachfront property, zoning (state and local), present levels of recreational use, and environmental impact.

c. Marine and Coastal Birds

The greatest potential impact on birds is thought to come from accidental discharges of oil and by intentional discharge of oil from tankers. Although mass fatalities are often observed after spills of crude and heavy fuel oils, it has been estimated that

only 5-15 percent of those birds actually killed by oil wash ashore where the death toll is taken (Nelson-Smith, 1972). Nevertheless, estimates for some spills are 40 thousand to 100 thousand fatalities for the Torrey Canyon spill (Smith, 1968), 3686 for the Santa Barbara blowout (Straughan, 1971), and 7000 for the San Francisco spill of Bunker C. (Chan, 1973; Boesch et. al., 1974). A more recent incident occurred on February 10, 1976, when an oil spill from a sunken Stewart Petroleum Company barge was discovered off Smith Point, Virginia, in the Chesapeake Bay. Seepage from the sunken barge continued for several weeks eventually resulting in a spillage of 250,000 gallons of heavy tar-like oil (Kiernan, 1976). The spill killed an estimated 10,000 birds wintering in the Bay and threatened clam and oyster beds along the shore. Another 118,000 gallons reported still missing was apparently congealed at the bottom of the Bay at the time of this writing.

The immediate effect of oil on birds is the fouling of their feathers. Clark (1969) reports that feathers become matted together and the repellant and insulation properties are lost, as well as their buoyancy. Birds can lose their ability to fly (Erickson, 1963), diving ducks lose their ability to dive for food (Chubb, 1954), or they become so soaked they drown (Tuck, 1960). Hartung (1967) reports that heavily oiled ducks lose more than twice the normal amount of body heat due to the breakdown of the insulating properties of plummage. To compensate for the additional loss, they develop a very high

metabolic rate which often leads to accelerated starvation. Ingested oil is lethally toxic to birds and often results in inflammation of the digestive tract or disturbs other physiological processes (Boesch et al., 1974). One study showed that seawater-adapted mallard ducklings ingesting 12.5 ppm (lowest level tested) of crude oil demonstrated a diminution of intestinal mucosal transfer rates of Na+ and water thus diminishing the amount of water available to the organism (Crocker, et al 1974). The study further postulates that dehydration resulting from impairment of mucosal transfer mechanism may be an important factor contributing to the high mortality among oil-contaminated seabirds. Hartung and Hunt (1966) have demonstrated that various industrial oils can cause lipid pneumonia, gastrointestinal irritation, fatty livers, and adrenal hyperplasia with dosages that were considered to be less than amounts thought to be ingested during preening activities. Small doses of relatively non-toxic oil were also found to disrupt egg laying and Hartung believes that it could cause nesting failure for many species (Hartung, 1965). He also demonstrated that embryo viability can be greatly reduced when the eggshell becomes smeared with oil from the contaminated plumage.

It is thought that some species of sea birds are more prone to oiling than others. Previous reports and observations have shown that diving birds suffer the most direct fatalities whereas others, such as gulls and shearwaters, suffer the least. Reports indicate that

the vulnerable species are those that are attracted by slicks and consequently land on them. Bourne (1968) suggests the explanation that oil makes the water calm, or resembles food or tide rips, or shoaling fish associated with the presence of food. He also observed that swimming birds do not notice slicks until they come in contact with them and are consequently trapped. While some species, such as gulls fly away, others such as murres, dive beneath the surface. Surfacing into the slick would be fatal as was observed for alcids killed during the Torrey Canyon spill.

Not all birds are equally vulnerable to oil slicks. Clark (1971) reports that in Western Europe, auks, puffins, razorbills, murres, and other sea ducks suffer the most fatalities as a consequence of spills. Boesch et al. (1974) report that from the Santa Barbara spills, loons and grebes, which account for 7 to 10 percent of the total bird population suffered 64 percent of the mortality. A main concern is that many sea birds are long lived and breed slowly which can make recovery of a population very difficult if populations are reduced to a small size.

The bird population of the Atlantic Coast is mainly comprised of migratory species. During the migration period, large populations are concentrated within specific Mid-Atlantic areas in this Mid-Atlantic Flyway area (Section III.D.1.e.). The most likely birds to be impacted are shorebirds, waterfowl and predatory birds, although other birds may also be impacted.

The migratory waterfowl are probably among the most susceptible due to their flocking habits and the large number of birds using the Atlantic Flyway. Large concentrations of these birds are often found in relatively small areas so that if a spill were to affect an area where the birds are congregated, high mortalilites might be expected. Flocks of migratory waterfowl could be expected. Flocks of migratory waterfowl could be impacted during the spring and fall migrations. Also, many waterfowl now winter in the Mid Atlantic area and therefore would be susceptible during the winter also. If oil should impact these areas, populations can be reduced through loss of habitat or direct fouling. It should be pointed out, however, that most of the refuges and other marshland areas are not liable to direct impacts from spilled oil during drilling or production activities, as most of them are situated within inlets or protected by barrier islands (Section III.D.1.e.). Marshland habitats would be most susceptible to spills from nearby pipelines or tanker accidents along their routes (Section III.D.1.a.). Marsh communities of coastal New Jersey and to a lesser extent those of coastal Delaware, Maryland and Virginia might be especially vulnerable to spills from pipelines. Communities adjacent to tanker routes in to New York harbor and Delaware Bay could be especially vulnerable to spills resulting from tanker accidents (Section III.D.1.a.).

If a major spill should occur as a result of this proposed sale, habitats utilized by shore birds in the Mid-Atlantic could be impacted. As Erickson (1963) reports, both habitats

and food supply are greatly reduced by oil deposits. Many shore birds rely on intertidal areas which could be affected as a result of a spill. The long-term damage to birds habitats from chronic oil pollution at sea may exceed that caused by irregularly occurring major spills. Murphy (1971) suggests that all hydrocarbons do not degrade readily and carcinogenic ones may persist in the marine environment.

The treating of oil contaminated birds has met with only limited success with the survival record being very dismal. According to Boesch et al., (1974), most birds perish soon after capture while others do not survive the cleaning procedures or the following recuperation period. The use of harmful detergents, improper feeding and handling of the treated birds are thought to have been responsible for the failure of early attempts of treating. Boesch et al. (1974), however, report that established British centers with trained personnel achieve nearly complete survival of treated birds.

Activities associated with pipeline burials, drilling, and construction of onshore facilities can affect bird populations in both offshore and onshore environments. If pipeline burial and drilling activities should resuspend toxic elements as metals and pesticides, they can enter food chains to affect bird populations (Appendix 9). Onshore impacts from onshore activities that can occur are loss of habitats and other environmental disturbances. The extent of the

impacts would depend on time of year and where they occurred. During the migratory or breeding seasons, OCS-related activities could affect bird populations if they should occur nearby. The long-term effects of pipeline burials are not known but are not expected to permanently damage bird habitats (possible pipeline locations are discussed in Section III.D.1.a.). Onshore facilities. depending on the type facility, can impact bird populations if they are constructed in sites utilized by birds. If facilities should create changes, as in air and water quality, noise, and so on, they can affect surrounding populations.

In summary, our conslusions are as follows:

Oil spills - The impact of oil on various species of birds is directly related to their behavior patterns and habitats they are dependent upon. Sea birds undeniably receive the greatest impacts, and mortalities can be high as previous cases have shown. Because of the location of proposed tracts for lease, these species would be most likely to receive impacts from an oil spill in the offshore Mid-Atlantic. In some cases, populations are suppressed for prolonged periods (Uspenskii, 1964). Onshore species can be impacted due to loss of feeding habitat and nesting sites and nests. They can also suffer from direct coating. These species are less likely to be impacted from an offshore spill. They could be impacted by pipeline breaks or leaks nearby or by tanker accidents.

It is impossible to predict the number of birds or species that would be impacted by an oil slick because of the numerous interplaying factors. The time of day, season of the year, and sea conditions all play important roles. Spills occurring in the migration periods of spring and fall would probably impact the greatest numbers and kinds of birds.

Groups of the area believed to be the most susceptible to contamination by oil at sea are: murres, auklets, murrelets, puffins, cormorants, loons, grebes, and scoters. Others, such as shearwaters, fulmars, petrels, gulls, terns, shorebirds, and some ducks and geese, are also vulnerable to contamination but less so.

Onshore activites - Activities associated with pipeline burials and construction of facilities can impact bird populations from disturbances these actions create and through loss of habitat. Disturbances associated with the construction stages are believed to be relatively short-termed and the extent of damage can vary. Loss of habitat due to placement of facilities is expected to be permanent, as well as any changes in the environment created as a result.

d. Wildlife

The impact on terrestrial wildlife could be direct through habitat encroachment and oil spills and secondary through potential oil spill contamination of food sources.

Direct impacts resulting from construction as a result of the proposed sale would be the greatest on the small mammals, reptiles, and amphibians of the area (distributions appear in Section II.F.2.c.) at construction sites. The extent of the impacts would ultimately depend on habitat recovery (Section III.D.2.a.) but should be limited in magnitude and of short duration. Only those individual animals having home ranges within or overlapping the actual zone of construction could be either destroyed or displaced. This zone could be narrow enough that the initial disturbance should extend little beyond it. There could be, however, a definite alteration of habitat within the construction zone. Whenever vegetation cover or habitat rendered unsuitable for one animal is replaced by another and its associated fauna, the net change from a food chain viewpoint could be minimal in localized areas. However, if the revegetation by previous types does not occur relatively quickly, the net change is greater.

Any impact occurring within a construction zone should be well dissipated just outside. This means that there should be little measureable indirect impact on the total system stemming from impact on small animal forms (mammals, reptiles, and amphibians). Much the same can be said for the larger rodents and small predators. There should be little adverse direct or indirect impact on these species.

There is potential for direct and indirect impact on both the very small animal forms and larger mammals and predators during any pipeline operation.

There could be direct, adverse, short-term impact on small animals (mammals, reptiles, and amphibians) anywhere that an oil spill occured or reached shore. The impact would depend on the place, the habitat, and the season of the year. It might range from minute to severe depending on the circumstance. There is insufficient information available to evaluate the long-term and indirect effects of oil spills upon small mammals. Shore areas most susceptible to spills would be along pipeline and tanker routes. Communities of coastal New Jersey and to a lesser extent those of Delaware, Virginia and Maryland might be especially vulnerable to pipeline spills while those communities that surround tanker routes into New York Harbor and Delaware Bay might be especially vulnerable to tanker spills (Section III.D.1.a.). Offshore spills occurring in the proposed leasing area are not expected to reach shore areas (III.A.4.).

Through the beach and marsh vegetation and carrion links in the food web, it is possible that oil pollution could affect terrestrial mammals which either constantly or intermittently use habitats subject to oil pollution. Intermittently, deer and other foragers, and rodents, utilize beach and intertidal zone plants exclusively and would thus be vulnerable to the threat.

Ingestion of oil-covered carrion by foxes, skunks, and shrews would result in petroleum hydrocarbons being assimilated directly at the top of the food chain; however, the relative toxicity of crude oil

to these mamals is not known at the present.

The impact on beach-utilizing mammals of oil hydrocarbons that have become entrained in the marine ecosystems from chronic low-level sources is unknown. There is, however, evidence to suggest that chlorinated hydrocarbons, which may be resuspended for a time in the water column, could cause premature births in California sea lions with a resultant death of pups (DeLong, Gilmartin and Simpson, 1973). Additional chronic low-level data is presented in Appendix 9.

In summary, impacts resulting from the burial of pipelines and construction activities will probably be of limited magnitude and of short duration. Those species most likely to receive impacts are those in the immediate activity areas due to habitat loss and direct fatality.

Some mammals could die from ingesting oil from contaminated pelage while grooming (Alaska, 1971). Scavengers, such as foxes and skunks, could occasionally eat oil-killed animals, and foragers, such as deer, could eat oil contaminated vegetation, thereby ingesting petroleum. It is impossible to estimate possible losses since the effects on animals ingesting hydrocarbons is not well known at present.

Endangered Species and Species of Concern

Those onshore species liable to be impacted are the bald eagle (Haliaeetus), peregrine falcon (Falco peregrinus), the eskimo

curlew (Numenius borealis), and osprey (Pandion haliaetus). Adverse impacts may result to these species by ingesting oil contaminated food. The actual effects resulting from ingesting oil contaminated food are not known at this time. A very remote possibility would be the ingestion of marine forms which incorporated pesticides or metals resuspended during drilling and dredging operations. Additional food chain data is given in Appendix 9.

Another possible effect on these birds (osprey and eagles especially) could be reproductive in nature. In experiments with mallard ducks, Hartung (1965) found that consumption of small amounts of oil disrupted egg laying activities. He also found that eggs smeared with oil had a very low hatching rate. This effect has been noted in osprey on Gardiner's Island, Long Island but the small sample size and low reproductive success of the remainder of the colony makes it impossible to confidently state that oil was the cause for the failure of the eggs to hatch.[1]

Little or no habitat utilized by these species is expected to be lost as a result of the proposed sale. As discussed in previous sections, most of the operations will be restricted to very small areas or corridors. Little habitat is expected to be lost to permanent installations. Possible problems OCS-related facilities may create and possible impacts are discussed in Section III.D.1.d.

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[1]Paul Spitger, Cornell University, personal communication, 1976.

It is felt that no additional endangered species will be impacted as a result of this proposal although no absolute statement can be made concerning the short-nosed sturgeon due to the present lack of knowledge of the habits of the sturgeon.

e. Water Quality

Changes in the population and industrial sectors as a result of the possible discovery of oil and gas resources in the proposed Mid-Atlantic sale area, would induce changes in the water quality of onshore areas in excess of the changes that would occur due to normal growth and development. Maximum increases in population of approximately 5600 to 20,800 persons, with no one county expected to receive more than 10,000 persons, are indicated (Section III.D.1.c.). Increases in most industrial activities would be less than one percent (Section III.D.1.b.). The exceptions would be the construction industry and the newly required gas processing industry. Construction activities, e.g., operations bases, gas processing plants, access roads, moorage facility construction, dredge and fill operations, and so on, would increase the volume of surface runoff and create problems of turbidity and siltation in rivers, streams, and estuaries, and could cause the loss of shellfish beds and fish spawning areas. These types of activities are considered most likely to occur in the rivers and nearshore areas of New Jersey and to a lesser extent of Delaware and Maryland. Nonpoint sources, such as these, are difficult to control and at present, do not fall under the regulatory authority of EPA. Guidelines for attempting to control runoff from these various sources have been published. Estimates of actual volumes are not possible

at this time since the volume is a function of rainfall, slope, erosion control practices, and so on.[1] These and other forms of water pollution resulting from industrial and residential practices that are directly or indirectly stimulated by OCS development, will generate cumulative effects that will degrade existing water quality unless controlled.

Gas processing plants use only 15,000 gallons of water per day and would not seriously affect the water supply of an area. Their contribution of water pollutants would be minimial (CEQ, 1973). In addition, any industrial expansion or development would fall under the EPA effluent guidelines for point sources and the water quality standards. These guidelines require the "best practicable" treatment after 1977 and the "best available" after 1983, which should prevent other than incremental deterioration of existing water quality.

An estimate of the degree of deterioration of water quality during peak production years due to the increase in population can be made by estimating the increase in sewage loadings. As a "worst" case situation for those areas considered most likely to receive a major

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[1]Environmental Consequences of Onshore Activity in Four New Jersey Coastal Counties Resulting from Offshore Oil Development. Technical report available from National Technical Information Service, Springfield, Virginia. Accession No.PB 249349/AS. A typical rate for clearing of land would be 18,700 tons per square kilometer of land used.

portion of the development, Areas 13, 14, 15, and 16 (Section II.D.2.), the maximum increase of 20,800 persons will be used. For those Areas not expected to receive a major portion of the development (Areas 12, 18, 20, and 21), a figure of 13,200 persons (mean of anticipated maximum population increases) will be used. These population changes represent increases in the BOD (biochemical oxygen demand) loadings of 1,241,000 pounds per year and 819,060 pounds per year, respectively, based on a figure of 0.17 pounds per person per day. Areas 13, 14, 15, and 16 include New York City, Long Island, and New Jersey. If such increases occurred in Area 13, New York City and Long Island, this would add approximately 10 percent to the already anticipated loadings. As such, it would not require modification of or additions to existing systems. Any deterioration of the water quality of the Area would, in relative terms, be small. In Areas 14 and 15, inland New Jersey, the increase would be approximately 20 percent. This increase could result in the overburdening of local treatment systems if the population increase was not distributed throughout the area. The greatest change would occur in coastal New Jersey, Area 16. An increase of this magnitude would more than double the presently expected future loading and lead to the lowering of the level of water quality of the Area if corrective action were not taken.

In each of these three Areas (14, 15, 16), the effects of increased loading could be mitigated by the development of new treatment facilities and the upgrading of existing facilities in accordance with the amended Federal Water Pollution Control Act (Section I.F.2.d.).

This requires that municipal sewage treatment plants have secondary treatment after 1977, which could effect a reduction of 85 percent in BOD loadings and thereby improve the quality of the effluent and receiving water.

The other Areas which might experience development but would be expected to receive a smaller portion of the total include upstate New York, Delaware, Maryland, and Virginia. For three of these, Areas 12, 18, and 21, the percentage increase in BOD loading would be approximately 30 percent. The development of additional or improved treatment capacity would be required to prevent deterioration of water quality, especially if the population increase was not distributed throughout the areas. In Area 20, this addition would approximately double the presently expected increase and lower the existing level of water quality. Here too, the impacts could be reduced if treatment plants are developed or upgraded to secondary treatment levels as required.

In order to estimate the impact of increased demand on existing water supplies, a figure of 1000 gallons per person per day will be used. This includes municipal, commercial, and industrial needs, with municipal and commercial needs representing approximately 20 percent of the total, and industrial needs the remaining 80 percent.

Using the same maximum population increases in the same Areas discussed previously, the increased demand would be approximately 13 million and 20 million gallons per day, respectively. This would represent approximate increases of one percent for Areas 13, 14, 15, and 18, two percent for Areas 12 and 21, and 15 to 18 percent for Areas 16 and 20. Table III-34 shows the present water use and supply and the additional water available from various sources or practices. As indicated, even in Areas of changes greater than 10 percent, the increases could be accommodated by increasing storage capacity of developing ground water supplies. Certain small communities, however, could suffer if a large percentage of the population increase occurred in one area. Several Atlantic coastal counties of New Jersey (Cape May, Atlantic, Ocean) and counties of the Delmarva Peninsula might have to develop the aquifers in other counties and transport the water in by pipelines. According to EPA,[1] the Cohansey aquifer which underlies the Pine Barrens of New Jersey could possibly be impacted in this way by induced onshore development from this proposed sale. The impacts discussed above would only occur if the maximum population increase expected under the high discovery case (2.6 billion barrels of oil) was to be

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[1]EPA, Written Comments, DES for Proposed OCS Lease Sale #40, 1976.

Table III- 34 . Total Practical Development Resource
(All figures in mgd)

| | 1972 Demand (1) | Average Annual Runoff (2) | Existing Resource[1] (3) | Additional Yield From Storage (4) | Additional Yield From Ground Water Rural (5) | Additional Yield From Ground Water M&I (6) | Additional Yield From Ground Water Total[2] (7) | Total Practical (3)+(4)+(7) |
|---|---|---|---|---|---|---|---|---|
| Area 12 | 541 | 13,190 | 2,261 | 4,974 | 509 | 1,066 | 603 | 7,838 |
| Area 13 | 1,680 | 1,900[3] | 623 | - | - | 654[4] | 589 | 1,212 |
| Area 14 | 1,556 | 2,580 | 852 | 550 | 23 | 443 | 94 | 1,496 |
| Area 15 | 2,452 | 13,200 | 4,840 | 2,094 | 320 | 1,475 | 628 | 7,562 |
| Area 16 | 114 | 2,450 | 845 | 199 | - | 188 | 21 | 1,065 |
| Area 18 | 1,433 | 5,500 | 1,085 | 222 | 61 | 730 | 161 | 1,468 |
| Area 20 | 110 | 3,680 | 78 | 1,359 | 189 | 173 | 265 | 1,702 |
| Area 21 | 639 | 7,450 | 674 | 1,702 | 379 | 783 | 562 | 2,938 |

[1]Available before use; includes allowances for consumption, yield of existing storage, and yield of the following authorized projects: Beltzville and Tocks Island in Area 15, and Gathright in Area 21. Flow developed for export is included in resource of the originating Area.

[2]Effective total; that is, the portion of practical development additive to existing resource after allowance for existing ground water use and substantive effects.

[3]Includes estimate of subsurface outflow of ground water.

[4]Includes 300 mgd anticipated artificial recharge.

(Adapted from NAR, 1972)

concentrated as indicated. In addition, it should be noted that these biological oxygen demand loadings and water supply demands are based on the maximum peak population levels which are not expected to be maintained in counties in which the economic infrastructure is not adequate, for example, Area 18 and parts of Area 16. These increases would be expected to create short-term problems if this is recognized since the investment and development necessary to accommodate peak levels would not then be made.

Another type of water quality impact to consider is that of onshore oil spills. These may occur from pipelines, or less likely from tank farms and handling facilities. These various sources are regulated and inspected by State and Federal agencies, but both large spills and long-term leakages could occur. This oil could contaminate surface waters and seep into underground aquifers. If this happens, alternative sources of supply would have to be developed until the problem is corrected.

f. Air Quality

Changes in population and in the commercial and industrial sectors as a result of the possible discovery and development of oil and gas resources in the proposed Mid-Atlantic sale area, would induce changes in the air quality of the affected onshore areas in excess of the changes that would occur with normal growth and development. Changes in population have a direct effect on the number of vehicle miles traveled (VMT) and on the volume of residential fuel needed. Changes in economic activity affect the levels of output and fuel use in the commercial and industrial sectors. The major pollutants associated with these sources are indicated in Table III-35 . The anticipated changes in the categories themselves are described in Sections III.D.1.b. and III.D.1.c.[1] Indications are that, for the region as a whole, during peak production years in the mid 1980's the increases in population (5600 to 20,800 maximum) are insignificant (<.01 percent) and those in most commercial and industrial sectors are less than one percent.

The exceptions are the anticipated increase in the levels of construction, due to the need for onshore support facilities, pipelines, access roads, and so on, and the development of gas processing plants where none existed before. Construction activity increases the suspended particulate loadings of the air which increases hazing and soiling. Gas treatment plants, even with the various advanced

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[1]Anticipated changes in industrial sectors are also discussed in Technical Paper Number 1-New York OCS Office: Economic Study of the Possible Impacts of a Potential Baltimore Canyon Sale. Available from National Technical Information Service, Springfield, Va. Accession No.PB249199/AS. Also available from the Bureau of Land Management.

Table III-35.

Sources of Air Pollutants

| SOURCE | MAJOR POLLUTANTS[1] |
|---|---|
| **TRANSPORTATION** | |
| Personal (Automobile and Bus) | SP, $SO_x$, $NO_x$, HC, CO |
| Freight (Trucks) | SP, $SO_x$, $NO_x$, HC, CO |
| **RESIDENTIAL FUEL USE** | |
| Natural Gas | SP, $SO_x$, $NO_x$, HC, CO |
| Distillate Oil | SP, $SO_x$, $NO_x$, HC, CO |
| **COMMERCIAL FUEL USE** | |
| Distillate Oil | SP, $SO_x$, $NO_x$, HC, CO |
| **INDUSTRIAL FUEL USE** | |
| Coal, Gas, Oil | SP, $SO_x$, $NO_x$, HC, CO |
| **ELECTRIC UTILITIES** | |
| Oil | SP, $SO_x$, $NO_x$, HC, CO |
| **INDUSTRIAL SOURCES** | |
| Gas Processing | $SO_x$, $NO_x$, HC |
| Construction | SP |
| Petroleum Refining and Storage | HC |
| Others (Chemicals, Manufacturing) | SP, $SO_x$, HC |
| **CONSUMER ACTIVITIES** | |
| Dry Cleaning | HC |
| Painting | HC |
| Gasoline Service Stations | HC |

[1]Suspended Particulates (SP), Sulfur Oxides ($SO_x$), Nitrogen Oxides ($NO_x$), Hydrocarbons (HC), and Carbon Monoxide(CO)

treatment devices, add sulfur and nitrogen oxides to the air which cause odor problems and could increase the acidity of rain in the area. The extent of the odor problems, however, could depend on the quantity of sulfur in the natural gas discovered. If other industries, such as petroleum refining, do expand more than the anticipated percentage, they would only incrementally increase the air pollution loadings since EPA has issued performance standards for most of the affected industries.

The anticipated increases for the Mid-Atlantic coastal region as a whole are so small that region-wide no noticeable deterioration of air quality would occur. In the case of specific cities or counties however, increases in population or industrial activity may be large enough to increase the air pollution loading to such an extent that the quality deteriorates. The degree of deterioration experienced in such cases would depend on: existing conditions; the degree of implementation of EPA guidelines for industrial source emissions and non-significant deterioration[1] , and the degree of implementation of state regulations regarding air pollution including those governing complex sources[2]. Any increases in the levels

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[1]EPA has established limits for increases in the levels of suspended particulates and sulfur dioxide in three classes of areas. At present, all areas in the country are listed as Class II. This classification allows increases of 10$\mu g/m^3$ in the annual geometric mean of suspended particulates and of 15$\mu g/m^3$ in the annual arithmetic mean of sulfur dioxide.

[2]New York has a complex source regulation which requires a builder to obtain a permit to construct a facility, for example, a shopping center or airport, that would increase the ambient levels of carbon monoxide or hydrocarbons by drawing more cars to a specific area.

of air pollutants related to mobile sources would be modified by the increased prevalence of the newer emission controls and devices.

These impacts would be difficult to quantify because the industrial and commercial base is so complex and varies greatly within the region. In an attempt to ascertain these effects on air quality, BLM requested an EPA research team to conduct a special environmental study.[1] The study was based on the expected changes in population and in the commercial and industrial sectors of four New Jersey coastal counties (Monmouth, Ocean, Atlantic, and Cape May) engendered by a high discovery case for oil and gas (2.6 billion barrels and 12.8 trillion cubic feet). The study indicated that the greatest changes occurred in the levels of $SO_x$, HC and CO due to the development of gas processing plants and the additional VMT associated with increased construction activity. The percentage increases in $SO_x$ ranged from 20 to 100 percent with Atlantic County experiencing the greatest change. The percentage increases for HC and CO were significant only in Cape May County (20 to 40 percent); other counties experienced increases of less than 10 percent. The increases in SP and $NO_x$, the other pollutants studied, were five percent or less for all counties except Atlantic County (an $NO_x$ increase of 9 percent expected in 1985). This study was based on the most up-to-date

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[1] Environmental Consequences of Onshore Activity in Four New Jersey Coastal Counties Resulting from Offshore Oil Development. Available from National Technical Information Service, Springfield, Va. Accession No.PB249349/AS.

information available and took into account in its projections the various air pollution control regulations and techniques that have been and will be implemented over the time period studied. Because of this, the predicted estimates may not agree with those currently available from older studies since certain improvements in existing plants, changes in air pollution regulations, and changes in fuel sources have recently occurred.

The study was designed to estimate the increased emission levels of various air pollutants. It was based on certain known factors relating to the sources of air pollutants and the methods of controlling them. It was not able to convert these estimates of emissions of pollutants into estimates of their effect on ambient air quality levels since no realistic methodology for doing so exists at present.

The four counties studied represent various degrees of population density and commercial and industrial development. As such, the results indicated for them may provide guidelines for estimating the effects in other counties similar to them in air quality, population, and economic base. Section II.E. contains a description of the existing air quality in the potentially affected areas.

For example, Nassau County, New York, and Prince Georges County, Maryland, are closely akin to Monmouth County in these three categories. Increases in the levels of various air pollutants

could therefore be expected to develop within the same ranges if gas processing plants and other onshore facilities were to develop in the regions in which the counties are located. The $SO_x$ levels in these counties are below the standard levels, and a 20 percent increase would neither raise the levels above the standards nor probably qualify as significant deterioration under EPA guidelines. Some localized problems could, however, develop in the immediate vicinity and down wind of the gas processing plants, for example, malodorous smells and acidic rain. The one to three percent increases in SP, HC, and CO would not alter existing situations in the counties. In areas that presently have difficulties with these HC and CO levels, the small increases might aggravate the problem but would not modify any downward trends. Changes in $NO_x$ levels of approximately one percent would not represent a significant increase in these counties. Increases in levels of all of these pollutants can be expected to be offset (to a undetermined degree) by the use of improved control devices on both stationary and mobile sources and by other pollution abatement activities.

Counties at the other end of the spectrum, similar to Cape May, would include Kent County, Delaware; Wicomico County, Maryland; Acomack County, Virginia; and other sparsely populated counties with very limited industrialization. The levels of all major air pollutants are below local and EPA-established standards at almost all times in these areas. A 25 to 50 percent increase in the levels of $SO_x$,

similar to that predicted for Cape May, would not raise the existing levels above the standards, or probably qualify as significant deterioration. Only in the vicinity of gas processing plans would high levels of $SO_x$ and the attendant problems of increase in acidity of rain be expected. Increases in the levels of SP and $NO_x$ would be approximately 5 percent, which would not be expected to modify existing conditions. The levels of HC and CO, however, would increase approximately 30 percent. This increase could cause the standards to be exceeded in and near the construction areas or in other congested areas because of the increase in cars and trucks. Increases of this magnitude would retard any presently existing downward trend.

The air quality in most of the above mentioned areas is good. Because of this, the counties have the ability to absorb a greater absolute quantity of pollutants before the resultant deterioration would qualify as "significant" under EPA quidelines. Although not necessarily desired by local officials and residents, this could encourage industry to locate in these areas if sufficient support facilities were available or were developed.

Othe counties with various populations and levels of industrialization would fall somewhere in between these two extremes. If they are directly affected, that is, if gas processing plants are

built or construction activity occurs in the area, the increases in levels of $SO_x$ and SP may qualify as significant deterioration. Increases in HC, CO and $NO_x$ could range between 1-10 percent.

The EPA environmental study for BLM did not include the metropolitan areas. However, based on the density of population and the degrees of industrialization that exist, some assumptions can be made. If the expected development were to occur in densely populated and highly developed areas, such as New York, New York; Baltimore, Maryland; Philadelphia; or Hudson County, New Jersey; the overall impact on air quality would be minimal. All of these areas have levels below the standards for $SO_x$ and could be expected to be able to absorb the increases in population and in the industrial and commercial sectors without a noticeable percentage increase in pollutants except perhaps in the immediate vicinity of the gas processing plants. Percentage increases in SP HC, CO, and $NO_x$ would probably be small, however, since the levels of these pollutants in some of these areas already exceed the standards, any developments that would add to these levels could be considered serious impacts. Similar conclusions can be drawn for other metropolitan areas, for example, Hampton, Virginia, that are also industrialized and have high population densities.

To reiterate, the above discussions are based on a high discovery case and the anticipated impacts would be of less magnitude if less development occurs. The increases in the levels of $SO_x$ would be

smaller if less gas was discovered and, as a result, smaller capacity of fewer processing plants were needed. Also, if the discovered gas had a very low percentage of $H_2S$, smaller amounts of $SO_x$ would be produced. The increases in HC, SP, and CO would also be smaller if the requirements for additional population, construction, and so on were less. Finally, any increases in air pollutants generated would be offset by the required improvements in emission control technology.

With regard to the impacts associated with gas processing plants and acidic rain, no estimates can be made regarding the degree of possible impacts at this time. The results of the environmental study indicated that under worst case conditions--high sulfur content of gas and 1971 control levels, rather than most stringent controls--a plant with a capacity of one billion cubic feet per day would emit up to 87,000 tons of sulfur oxides per year. This would be a significant load and would present the potential for increases in acidity of precipitation. However, whether lower pH levels would actually occur would depend upon a complex set of variables, including the constituents of precipitation in the area. Much of the effect would depend upon the amounts of nitric acid in precipitation as well. Therefore, no prediction can be made as to whether a gas processing facility would actually increase the acidity of precipitation, or if it did, the areal extent of effect.[1]

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[1]E.E. Likens, Section of Ecology and Systematics, Cornell University, personal communication.

The effects of acid rain are not yet well understood. They may include changes in leaching rates of nutrients from plant foliage, changes in leaching rates of soil nutrients, acidification of lakes and rivers, effects on the metabolism of organisms, and corrosion of strucutres (Likens, 1974).

There are presently no known studies of precipitation acidity increases due to gas processing plants.

E. Proximity Evaluation

1. Purpose

A proximity evaluation is, in general, a system whereby each tract is analyzed in relation to pertinent factors resulting from the proposed sale which may result in an impact on the environment. Its purpose is to provide the decisionmaker with an environmental analysis of each tract regarding the possible risks which relate to them.[1]

2. Significant Resource Factors

All tracts which are included in this proposed lease sale are evaluated as to their proximity to significant resources. These significant resource factors have been divided into two major types: natural and cultural resources and multiple use activities. These two major types have been further divided into various subgroups. These subgroups are listed below along with explanations as to how the measurements were made for each subgroup.

a. Natural and Cultural Resources

Refuges/Wildlife Management Areas. Measurements were made from the most shoreward point of each tract to the nearest shoreline of these refuges or management areas.

Marsh Communities. Measurements were made from the most shoreward point of each tract to the nearest marsh community.

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[1]See Appendix 10 for the matrix analysis.

Sandy Beach Intertidal Communities. Measurements were from the most shoreward point of each tract to the nearest sandy beach community.

Sand and Gravel Deposits. Measurements were made from the closest point in each tract to the nearest offshore sand and gravel deposit.

Aesthetics. Measurements were made from the most shoreward point of each tract to the nearest shoreline. Aesthetics, for the purpose of this evaluation, refers to the visibility of oil spills impacting on the view from shore regardless of whether that shoreline is being used residentially or recreationally.

Archeology. Measurements were made from the closest point in each tract to the 120 m contour line which approximates the maximum seaward extent of the coast since man has inhabited North America.

b. Multiple Use Activities

Shipping and Ocean Dumping. Measurements were made from the center of each tract to the nearest commercial traffic lane or dumpsite.

Outdoor Recreation. Measurements were made from the most shoreward point of each tract to the nearest shoreline.

Commercial Fishing. Since some form of commercial fishing occurs throughout the entire proposed sale area, all tracts will be affected. Therefore, all tracts will be considered to have the maximum effect possible on commercial fishing.

Sport Fishing. Measurements were made from the most shoreward point of each tract to the approximate center of each fish haven or to the nearest shoreline if it is closer.

The reader is referred to Section II, Description of the Environment, for a detailed description of each of these resources and activities and to Section III, Environmental Impacts of the Proposed Action, for a detailed analysis of the various impacts which could affect them.

3. Impact Producing Factors

This proximity evaluation contains two major categories of factors which can cause an impact on either natural and cultural resources or multiple use activities: oil spills and structures. Oil spills, for the purposes of this evaluation, are defined as spills of 1000 barrels or more, while structures are defined as being platforms and any fixed structures. Various other impact-producing factors (for example, debris, pipelines, and other transportation modes) are very difficult to determine on the basis of individual tracts and, therefore, have not been considered in this section. These other factors, however, have been discussed in some detail elsewhere in this statement.

4. Proximity Values

Each individual tract has been assigned a proximity value for oil spills and structures respectively. This value is based solely on the individual tract's distance from significant resource factors.

a. Oil Spills

It has been observed (Smith, 1968) that oil on the water's surface tends to move at a velocity which is approximately equal to the vectorial sum of 3 percent of the surface wind velocity. The reader is reminded of the fact that, by adding approximately 3 percent of the surface wind velocity plus the current velocity vectorially, the ultimate direction of the oil's movement is also taken into account. The M.I.T. model (Section III.A.4)[1] has predicted that an oil spill emanating from either EDS 6 or EDS 7, during the winter, will require a minimum of 46 days before impacting some portion of the shoreline. From the outlying tract 47 miles from shore, a spill might take 29 days to reach a shoreline. This is the worst possible case based on the one analysis which covered most of the potential lease tracts for each season. Although the study of Miller et al. (1975) showed a much faster time to shore and is perhaps more sensitive to the actual meteorological and water current framework

[1]Section III.A.4. described oil spill trajectory models, including that of Stewart et al. (1974b).

than the MIT model, the incompleteness of the Coast Guard study for purposes of analysis for this lease sale proposal precludes its use in the proximity analysis. The OCS Spill Risk Analysis study discussed in Section III.A.4., indicates that in the worst case a hypothetical spill reached shore in 4 days, and that 37 percent of the spills occurring reached shore in 15 days or less. However, since this OCS risk analysis has not yet been compared with other studies regarding its validity, for purposes of this proximity analysis the MIT model has been utilized. Since EDA 6 and EDS 7 are located 69 miles and 78 miles, respectively, from the nearest point of shore (Section III.A.4.), this gives an average distance from shore of 73.5 miles. If it is then assumed that distance from shore is linearly related to time to shore, and that a spill will travel the shortest distance, an average speed of 1.6 miles per day is derived. This average speed can then be converted into 0.6 days per miles. For the purposes of this evaluation, a proximity scale has been developed which is based on the following assumptions:

- An oil spill of 1000 barrels or more has occurred.
- The rate of shoreward drift of the oil spill in this proposed sale area is 1.6 miles per day or 0.6 days per mile.
- No distinction as to season has been made.
- The only physical, chemical, or biological process which the oil spill is assumed to undergo is evaporation. The evaporation rates are the same as those given in Section III.A.3.
- A twelve-hour response time is required in order to implement contingency measures to stop or retard the oil spill from reaching either shore or a high value, vulnerable resource area.

Thus, based on the closest tract of this proposal being 47 miles from shore, at 0.6 days per miles, an oil spill would take an average of 30 days to reach shore.

A value for oil spills has been assinged to each tract from the following scale:

Proximity Scale (Oil Spills) for Proposed Sale #40
Tentative Tracts

| Value Assigned to Tract | Distance in Days from a Significant Resource |
|---|---|
| 0.9 | 0.0 - 1.0 |
| 0.8 | 1.1 - 2.0 |
| 0.7 | 2.1 - 3.0 |
| 0.6 | 3.1 - 4.0 |
| 0.5 | 4.1 - 7.0 |
| 0.4 | 7.1 - 10.0 |
| 0.3 | 10.1 - 21.0 |
| 0.2 | 21.1 - 30.0 |
| 0.1 | 30.1 - 60.0 |
| 0.0 | 60.1 or greater |

b. Structures

Since offshore structures cause a different type of impact or conflict than oil spills, their proximity to a significant resource must be evaluated in a different manner. Thus, a structure placed in a tract either lies within a significant resource or multiple use area or lies outside these areas. The distances which tracts vary from a significant resource also do not have the same importance for structures as for oil spills.

A value for structures has been assigned to each tract from the following scale:

Proximity Scale (Structures) for Proposed Sale #40
Tentative Tracts

0.9 - Structure lies totally within a significant resource area

0.0 - Structure lies totally outside a significant resource area

There is one exception, however, to the above scale. If a structure lies within six miles of a shipping lane or dumpsite, it is assigned a value of 0.9.

## F. Recapitulation of the Proximity Evaluation

### 1. Refuges/Wildlife Management Areas

#### a. Oil Spills

| Proximity Value | Block Number | Total Tracts |
|---|---|---|
| 0.9 | --- | 0 |
| 0.8 | --- | 0 |
| 0.7 | --- | 0 |
| 0.6 | --- | 0 |
| 0.5 | --- | 0 |
| 0.4 | --- | 0 |
| 0.3 | --- | 0 |
| 0.2 | --- | 0 |
| 0.1 | NJ 18-3: 411-412, 453-458, 497-502, 540-547, 553-554, 584-591, 596-599, 628-635, 639-643, 673-678, 682-687, 718-730, 765-773, 809-813, 816, 854-858, 898-902, 942-945, 985-988<br>NJ 18-6: 16-19, 61-62, 98-100, 104-106, 139-144, 183-192, 226-235, 270-278 | 154 |
| 0 | --- | 0 |

#### b. Structures

None of the tracts which are proposed for leasing have a proximity value of 0.9 for structures. This indicates that no structures will be erected in these resource areas.

2. Marsh Communities

a. Oil Spills

| Proximity Value | Block Number | Total Tracts |
|---|---|---|
| 0.9 | --- | 0 |
| 0.8 | --- | 0 |
| 0.7 | --- | 0 |
| 0.6 | --- | 0 |
| 0.5 | --- | 0 |
| 0.4 | --- | 0 |
| 0.3 | --- | 0 |
| 0.2 | --- | 0 |
| 0.1 | NJ 18-3: 411-412, 453-458, 497-502, 540-547, 553-554, 584-591, 596-599, 628-635, 639-643, 673-678, 682-687, 718-730, 765-773, 809-813, 816, 854-858, 898-902, 942-945, 985-988<br>NJ 18-6: 16-19, 61-62, 98-100, 104-106, 139-144, 183-192, 226-235, 270-278 | 154 |
| 0 | --- | 0 |

b. Structures

None of the tracts which are proposed for leasing have a proximity value of 0.9 for structures. This indicates that no structures will be erected in these resource areas.

3. Sandy Beach Intertidal Communities

a. Oil Spills

| Proximity Value | Block Number | Total Tracts |
|---|---|---|
| 0.9 | --- | 0 |
| 0.8 | --- | 0 |
| 0.7 | --- | 0 |
| 0.6 | --- | 0 |
| 0.5 | --- | 0 |
| 0.4 | --- | 0 |
| 0.3 | --- | 0 |
| 0.2 | --- | 0 |
| 0.1 | NJ 18-3: 411-412, 453-458, 497-502, 540-547, 553-554, 584-591, 596-599, 628-635, 639-643, 673-678, 682-687, 718-730, 765-773 809-813, 816, 854-858, 898-902, 942-945, 985-988<br>NJ 18-6: 16-19, 61-62, 98-100, 104-106, 139-144, 183-192, 226-235, 270-278 | 154 |
| 0 | --- | 0 |

270-278

b. Structures

None of the tracts which are proposed for leasing have a proximity value of 0.9 for structures. This indicates that no structures will be erected in these resource areas.

4. Sand and Gravel Deposits

a. Oil Spills

| Proximity Value | Block Number | | Total Tracts |
|---|---|---|---|
| 0.9 | --- | | 0 |
| 0.8 | --- | | 0 |
| 0.7 | --- | | 0 |
| 0.6 | --- | | 0 |
| 0.5 | NJ 18-3: | 411, 453-455, 497-498 | 6 |
| 0.4 | NJ 18-3: | 412, 456-457, 499-500, 540-543, 554, 584-585, 591 | 13 |
| 0.3 | NJ 18-3: | 458, 501-502, 544-547, 553, 586-591, 596-598, 628-635, 639-643, 673-678, 682-687, 718-723, 726-730, 765-766, 771-773, 816 | |
| | NJ 18-6: | 226, 270 | 61 |
| 0.2 | NJ 18-3: | 724-725, 767-770, 809-813, 854-858, 898-902, 942-945, 985-987 | |
| | NJ 18-6: | 16-17, 98-99, 139-143, 183-187, 227-231, 271-274 | 51 |
| 0.1 | NJ 18-3: | 988 | |
| | NJ 18-6: | 18-19, 61-62, 100, 104-106, 144, 188-192, 232-235, 275-278 | 23 |
| 0 | --- | | 0 |

b. Structures

None of the tracts which are proposed for leasing have proximity value of 0.9 for structures. This indicates that no structures will be erected in these resource areas.

5. Aesthetics

a. Oil Spills

| Proximity Value | Block Number | Total Tracts |
|---|---|---|
| 0.9 | --- | 0 |
| 0.8 | --- | 0 |
| 0.7 | --- | 0 |
| 0.6 | --- | 0 |
| 0.5 | --- | 0 |
| 0.4 | --- | 0 |
| 0.3 | --- | 0 |
| 0.2 | --- | 0 |
| 0.1 | NJ 18-3: 411-412, 453-458, 497-502, 540-547, 553-554, 584-591, 596-599, 628-635, 639-643, 673-678, 682-687, 718-730, 765-773, 809-813, 816, 854-858, 898-902, 942-945, 985-988<br>NJ 18-6: 16-19, 61-62, 98-100, 104-106, 139-144, 183-192, 226-235, 270-278 | 154 |
| 0 | --- | 0 |

b. Structures

None of the tracts which are proposed for leasing have a proximity value of 0.9 for structures. This indicates that no structures will be erected in areas where aesthetics will be affected.

6. Archaeology

a. Oil Spills

| Proximity Value | Block Number | Total Tracts |
|---|---|---|
| 0.9 | NJ 18-3: 411-412, 453-458, 497-502, 540-547, 553-554, 584-591, 596-598, 628-635, 639-641, 673-678, 682-684, 718-728, 765-771, 809-813, 854-858, 898-901, 942-945, 985-988 | |
| | NJ 18-6: 16-19, 61-62, 98-100, 104-106, 139-144, 183-192, 226-235, 270-278 | 142 |
| 0.8 | NJ 18-3: 642, 685, 772, 902 | 4 |
| 0.7 | NJ 18-3: 599, 729, 816 | 3 |
| 0.6 | NJ 18-3: 643, 686, 730, 773 | 4 |
| 0.5 | NJ 18-3: 687 | 1 |
| 0.4 | --- | 0 |
| 0.3 | --- | 0 |
| 0.2 | --- | 0 |
| 0.1 | --- | 0 |
| 0 | --- | 0 |

b. Structures

Blocks NJ 18-3: 411-412, 453-458, 497-502, 540-547, 553-554, 584-591, 596-598, 628-635, 639-641, 673-678, 682-684, 718-728, 765-771, 809-813, 854-858, 898-901, 942-945, 985-988 and NJ 18-6: 16-19, 61-62, 98-100, 104-106, 139-144, 183-192, 226-235, 270-278 have a proximity value of 0.9 for structures. This indicates that part of the tract has a depth of 120 meters or less.

7. Shipping and Ocean Dumping

a. Oil Spills

| Proximity Value | Block Number | Total Tracts |
|---|---|---|
| 0.9 | NJ 18-3: 553-554, 596-599, 643 | 5 |
| 0.8 | NJ 18-3: 597, 642 | 2 |
| 0.7 | NJ 18-3: 687 | 1 |
| 0.6 | NJ 18-3: 596, 641, 686 | 3 |
| 0.5 | NJ 18-3: 458, 639-640, 683-685, 729-730 | 8 |
| 0.4 | NJ 18-3: 411-412, 455-457, 500-502, 546-547, 591, 682, 726-728, 771-773, 816 | 19 |
| 0.3 | NJ 18-3: 453-454, 497-499, 540-545, 584-590, 628-635, 673-678, 718-725, 765-770, 809-813, 854-858, 898-902, 943-945, 988 | 65 |
| 0.2 | NJ 18-3: 942, 985-987 | |
| | NJ 18-6: 16-19, 61-62, 104-106 | 13 |
| 0.1 | NJ 18-6: 98-100, 139-144, 183-192, 226-235, 270-278 | 38 |
| 0 | --- | 0 |

b. Structures

Blocks NJ 18-3: 553-554, 596-599, 641-643, 686-687, 730 have a proximity value of 0.9 for structures. This indicates that any structures erected on one of these tracts would be within six miles of a traffic lane or dumpsite.

8. Outdoor Recreation

a. Oil Spills

| Proximity Value | Block Number | Total Tracts |
|---|---|---|
| 0.9 | --- | 0 |
| 0.8 | --- | 0 |
| 0.7 | --- | 0 |
| 0.6 | --- | 0 |
| 0.5 | --- | 0 |
| 0.4 | --- | 0 |
| 0.3 | --- | 0 |
| 0.2 | --- | 0 |
| 0.1 | NJ 18-3: 411-412, 453-458, 497-502, 540-547, 553-554, 584-591, 596-599, 628-635, 639-643, 673-678, 682-687, 718-730, 765-773, 809-813, 816, 854-858, 898-902, 942-945, 985-988<br>NJ 18-6: 16-19, 61-62, 98-100, 104-106, 139-144, 183-192, 226-235, 270-278 | 154 |
| 0 | --- | 0 |

b. Structures

None of the tracts which are proposed for leasing have a proximity value of 0.9 for structures. This indicates that no structures will be erected within these resource areas.

9. Commercial Fishing

a. Oil Spills

| Proximity Value | Block Number | Total Tracts |
|---|---|---|
| 0.9 | NJ 18-3: 411-412, 453-458, 497-502, 540-547, 553-554, 584-591, 596-599, 628-635, 639-643, 673-678, 682-687, 718-730, 765-773, 809-813, 816, 854-858, 898-902, 942-945, 985-988<br>NJ 18-6: 16-19, 61-62, 98-100, 104-106, 139-144, 183-192, 226-235, 270-278 | 154 |
| 0.8 | --- | 0 |
| 0.7 | --- | 0 |
| 0.6 | --- | 0 |
| 0.5 | --- | 0 |
| 0.4 | --- | 0 |
| 0.3 | --- | 0 |
| 0.2 | --- | 0 |
| 0.1 | --- | 0 |
| 0 | --- | 0 |

b. Structures

Blocks NJ 18-3: 411-412, 453-458, 497-502, 540-547, 553-554, 584-591, 596-599, 628-635, 639-643, 673-678, 682-687, 718-730, 765-773, 809-813, 816, 854-858, 898-902, 942-945, 985-988 and NJ 18-6: 16-19, 61-62, 98-100, 104-106, 139-144, 183-192, 226-235, 270-278 have a proximity value of 0.9 for structures. This indicates that any structures erected on these tracts would be within the commercial fishing region of the Mid-Atlantic.

10. Sport Fishing

a. Oil Spills

| Proximity Value | Block Number | Total Tracts |
|---|---|---|
| 0.9 | --- | 0 |
| 0.8 | --- | 0 |
| 0.7 | --- | 0 |
| 0.6 | --- | 0 |
| 0.5 | --- | 0 |
| 0.4 | --- | 0 |
| 0.3 | --- | 0 |
| 0.2 | --- | 0 |
| 0.1 | NJ 18-3: 411-412, 453-458, 497-502, 540-547, 553-554, 584-591, 596-599, 628-635, 639-643, 673-678, 682-687, 718-730, 765-773, 809-813, 816, 854-858, 898-902, 942-945, 985-988<br>NJ 18-6: 16-19, 61-62, 98-100, 104-106, 139-144, 183-192, 226-235, 270-278 | 154 |
| 0 | --- | 0 |

b. Structures

None of the tracts which are proposed for leasing have a proximity value of 0.9 for structures. This indicates that no structures will be erected within these resource areas.

G. Summary Risk Analysis

This section will attempt to analyze all the tracts which are proposed for leasing according to their relative potential degree of hazard to the environment. It will also attempt to analyze the tracts as to their disruption or degradation potential to multiple use activities and/or aesthetics. Although this analysis is extremely subjective, it is based on the previously presented detailed environmental analysis, an understanding of industry's current technology capabilities, the proximity evaluation in Sections III.E. and III.F., and the matrix tables in the Appendix 10.

The nature of this analysis is also significantly different from the hazard analyses described by CEQ or the Department of the Interior first tier nominations (Section I.E.). Although the Mid-Atlantic OCS may have been described as having a certain hazard potential with respect to other leasing areas, the basis of those conclusions was either operating conditions or the possibility of oil spills reaching shore in a given amount of time. The analysis in this EIS examines relative impact to a variety of resources from hypothetical oil spills which might emanate from a specific tract plus impact to other ongoing uses of the Mid-Atlantic OCS.

1. Relatively High Hazard Potential

All tracts which have an oil spill proximity value of 0.8 or greater for one or more of the following categories are considered to have a relatively high hazard potential: Refuges/Wildlife

Management Areas, Marsh Communities, Sandy Beach Intertidal Communities, and Sand and Gravel Deposits. The tracts are so considered due to the nature of the impact which an oil spill could have on these resources. None of the 154 tracts are considered to have a relatively high hazard potential.

2. Relatively High Disruption Potential

In determining which tracts are considered to have a relatively high disruption potential to cultural resources or multiple use activities, the following criteria have been used: any tract having a structure proximity value of 0.9 for archaeology, shipping, or commercial fishing; and any tract having an oil spill proximity value of 0.9 for outdoor recreation, commercial fishing, or sport fishing. All the tracts (154) are considered to have a relatively high disruption potential.

3. Relatively High Aesthetic Degradation Potential

If a tract has an oil spill proximity value of 0.9 or a structure proximity value of 0.9 for aesthetics, then it is considered to have a relatively high aesthetics degradation potential. It must be remembered, however, that aesthetic quality is extremely difficult to define. Thus, aesthetic quality will not only vary with oil spill size, time to shore, and distance from shore, but will also vary with the individual observer. None of the 154 tracts have a relatively high aesthetic degradation potential.

## H. Cumulative Impact of the Proposed Sale and Other Federal Actions

### 1. Additional OCS Oil and Gas Lease Sales

The proposed action is a part of the program to accelerate oil and gas leasing on the United States Outer Continental Shelf. The proposed OCS Planning Schedule, released in June 1975 (Figure I-3), lists an additional tentative Mid-Atlantic sale in mid-1977 (Proposed Sale No. 49). This additional proposed sale will be scheduled somewhat later than indicated on the proposed Planning Schedule, commensurate with the change in scheduling for the present proposed OCS Lease Sale No. 40. An OCS lease sale proposal in the North Atlantic OCS area (Proposed Lease Sale No. 42) will be the subject of a site-specific draft environmental impact statement scheduled for publication about August 1976. According to tentative scheduling, if the Secretary decides to hold this North Atlantic lease sale, it would not be held before early 1977. In addition, another proposed lease sale in the South Atlantic (Proposed Lease Sale No. 43) will be the subject of a draft environmental statement scheduled for publication in October 1976. If the Secretary decides to hold this South Atlantic sale, it would not be held until sometime in the spring of 1977.

The effect of another Mid-Atlantic sale within sixteen months of the presently proposed sale No. 40 would be to increase oil and gas operations activity, increase peak activity levels, and generally extend the peak activity period and the 25-year timeframe anticipated for

the first proposed sale (contingent upon the discovery of resources). The number and amount of certain activities or substances introduced into the environment as a result of oil and gas activities would be additive in nature, such as number of platforms, volume of drill cuttings and formation waters disposed, and drilling muds released, into the marine environment. Possibilities of oil spills resulting from blowouts, since blowout probabilities are a function of the number of wells, would increase proportionately. If a future sale was to offer acreage much closer to shore, not only would the probabilities of oil spills increase but the probabilities of spills reaching shore would increase as well. In addition, nearshore sales, especially if they are successful, could stimulate pressure for lease sales in State waters. Attendant oil spill dangers in these areas would be even greater than those located farther offshore.

Since economies of scale could be achieved in some areas, certain activities would not increase in number or amount proportional to the increase in acreage leased or minerals extracted, should additional sales be held. Onshore support bases and pipelines, depending on the timing and success of additional operations, might require only marginal augmentation.

Our economic analysis indicates that the estimated high production levels for this proposed sale alone would not be enought to stimulate significant investment in OCS-related activities not site-specific in nature; i.e., activities would most likely not need to take place in the area of oil and gas operations, such as rig construction.

Increased oil and gas activity in the Mid-Atlantic might result in investments in these types of industries within the region.

With regard to the impacts associated with the varying levels of activity resulting from an additional Mid-Atlantic OCS sale, they would be of two different types. Some impacts would be additive in nature, such as the amount of acreage devoted to industrial use. Other impacts could be expected to be greater than the aggregate of the impacts of each sale, or cumulative. For example, the types and magnitude of economic activity expected to result from this proposed sale have been shown not to be great enough to maintain early increases in population and economic activity in some shore counties in which primary support facilities might be located (Section III.D.). An additional sale and possible higher levels of production might stimulate enough activity in sectors of the economy to result in more sustained levels of population and economic activity in localized areas. In addition, increased certainty for industrial location decisions could be provided by an additional future sale if this proposed sale should result in a favorable discovery of oil and gas resources, thus adding to the possibility of greater and/or sustained economic activity.

It is more difficult to anticipate possible cumulative impacts to marine organisms. An extreme example of cumulative impacts to biological systems would be the case in which threshold levels were reached by one additional action. For example, if the amount of chronic oil pollution or other effects of activities resulting from

a first OCS lease sale (in combination with other factors existing or proposed) were enough to reduce a population to a critical level, then any incremental activity could be expected to result in the possible destruction of that population. However, understanding of the complex relationships of the various living and nonliving components of the marine environment and the effects of OCS oil and gas development on them are not, in general, sufficient to allow identification of the cumulative impact of any proposed additional sales. Even on a sale-specific basis, the understanding, identification, and especially the quantification, of these impacts cannot be made with any certainty.

This environmental impact statement has attempted as much as possible to quantify expected impacts of this proposed sale. However, beyond quantifying the primary, most direct impacts (e.g., amounts of drilling muds which may be used, numbers of employees directly associated with primary facilities), quantifications of impacts are very difficult to estimate. The primary impacts react with numerous other factors which differ from specific area to specific area and whose relationships are often poorly understood. For example, any chronic oil pollution resulting from this proposed sale could combine with pollution from sewage outfalls, existing tanker pollution, surface run-off, and various other sources, depending on the location of occurrence of chronic low levels of oil. The organisms any oil pollution would affect may vary from specific locality to locality. The effects of chronic oil pollution alone on organisms is very poorly understood; in combination with other pollutants its effects

are even less well understood. Indeed, even primary effects cannot be predicted with any certainty because the location and amount (if any) of oil and gas resources are not known.

Quantifying cumulative impacts of this proposed sale and other possible sales becomes even more difficult. For example, in addition to the difficulties mentioned above, it is not known which, if any, of the tentatively scheduled lease sales will be approved by the Secretary, or, if held, the amount of acreage or location of acreage to be offered for lease sale. However, in order to place the potential effects in perspective it should be remembered that as the high case of the range for impact assessment for this proposed sale, this environmental statement uses estimates of undiscovered, recoverable resources amounting to 2.6 billion barrels of oil and 12.8 trillion cubic feet of gas (Section III.A.1.).

If later estimates of a lower level of recoverable resources are determined, the impact of development of the entire Baltimore Canyon area, including any additional sale(s), may not exceed in aggregate the high range of estimated impacts discussed in this environmental statement. However, the timing and possibly the locations would be different than discussed in this EIS, and the level of impacts estimated would be spread out over a longer period of time.

The cumulative impact of tentative OCS lease sales in other regions has been addressed in the Final OCS Programmatic EIS, released by the Bureau of Land Management in July 1975. It is possible that, if the Secretary decides to hold this proposed Mid-Atlantic lease

sale, and decides thereafter to hold a North Atlantic lease sale presently proposed, there could be some cumulative impacts resulting from the operations generated by these two sales. Similarly, there could possibly be some cumulative impacts resulting from a South Atlantic lease sale, should the Secretary decide to hold OCS Sale No. 43 presently proposed.

The North Atlantic OCS Lease Sale No. 42 proposal involves the potential leasing of about 1,172,796 acres situated in waters about 50 miles to 200 miles offshore from Nantucket Island, Massachusetts. Of the acreage proposed for this North Atlantic lease sale, the closest acreage to Long Island is approximately 100 miles away. The great bulk of the acreage proposed for lease is situated some 185 miles distant from Long Island. Distances from other states and communities in the Mid-Atlantic area would be considerably greater. The closest tracts to each other in the Mid-Atlantic proposed sale and the North Atlantic proposed sale are approximately 140 to 150 miles apart.

The South Atlantic OCS Lease Sale No. 43 proposal involves the possible leasing of about 1,280,966 acres situated in waters off the coasts of North Carolina, South Carolina, Georgia, and Florida from approximately 25 to 80 miles from shore. These tentative tracts are located over 500 miles from the tracts proposed in this Mid-Atlantic OCS Lease Sale No. 40 proposal.

Draft environmental impact statements for the proposed North Atlantic and South Atlantic OCS lease sales are being prepared. The Bureau

of Land Management expects to publish the North Atlantic DES in late summer 1976. The South Atlantic DES is being prepared for publication in October 1976. These draft statements will discuss any potential impacts of those sale proposals, if any, on the Mid-Atlantic coastline and the Mid-Atlantic States and communities. Moreover, these draft impact statements will discuss the potential cumulative impacts that could be generated by a North Atlantic or South Atlantic OCS lease sale following a Mid-Atlantic lease sale, assuming all three sales were held.

The discussion of potential cumulative impacts will include, among other things, the significance of potential environmental impacts on Mid-Atlantic coastal States and communities in light of (1) the location of potential leasing tracts; (2) additional potential sites for any support facilities or pipeline landings associated with the North and South Atlantic lease sale proposals; and (3) the potential impact on the fisheries resources of the North, Mid-Atlantic, and South Atlantic, to the extent that it might affect the interest of Mid-Atlantic States and communities. At this early stage of intensive study and analysis of potential environmental impacts of proposed lease sales No. 42 and No. 43, it is not possible to make a definitive statement with respect to the potential environmental impacts of these sale proposals, including any potential cumulative impacts.

2. Deepwater Ports

Deepwater port proposals have been put forth for the Atlantic Coast, including one for the mouth of the Delaware Bay in the Mid-Atlantic region, however, the Department of Transportation, the responsible Federal agency, has not received any permit applications for East Coast deepwater ports to date.

The extent to which effects of a deepwater port operating concurrently with OCS oil and gas leasing activities in the Mid-Atlantic region would be cumulative in nature would depend in part on whether such a port is built to accommodate existing crude imports or increased refinery capacity. (To a large extent, the provision of expanded refining capacity and associated deepwater ports will be a function of demand, market location, and transportation economics.) If deepwater ports on the Atlantic Coast result in a higher volume of crude transported and a higher volume of associated spills, then cumulative oil-related impacts to marine and coastal organisms could be expected. If deepwater ports are associated with new refinery capacity, cumulative economic and socio-economic impacts could accrue to the Mid-Atlantic region. The extent and nature of these impacts would depend on the location of the port(s), any new refineries, and OCS-related facilities.

It has been suggested that oil and/or gas from the OCS might be transported to shore through the same pipeline(s) serving a deep-water port. There is no provision for this in existing legislation,

and it is as yet unclear whether this would be possible. Existing legislation is administered by the Department of Transportation.

More information regarding the impacts of deepwater ports may be found in the Department of the Interior's Environmental Impact Statement on Deepwater Ports issued June 1973.

3. Offshore Nuclear Generating Plants

The only offshore floating nuclear generating plant proposal for the Mid-Atlantic is a two-unit plant which has been proposed by the Public Service Electric and Gas Company for a site 2.8 miles offshore of Little Egg Inlet, New Jersey. An Environmental Report for construction has been prepared by the proposer, and ecological studies have been conducted concerning siting and effects of such facilities. The Nuclear Regulatory Commission released a draft environmental impact statement on the proposed project in April 1976. Application has also been made by PSE & G to the New Jersey Department of Environmental Protection for several required construction and other permits and a riparian grants right. The project is proposed to commence with site preparation in 1979, and both units are to be in operation by 1987. The units themselves are to be constructed in Florida.

Impacts to marine organisms from operation of nuclear plants stem from entrainment, thermal pollution, chlorine content of disposed cooling water, and possible radioactivity. Erosion seaward of the breakwater and a zone of sediment accretion will also result from placement of the breakwater in conjunction with the proposed offshore units. Cumulative impacts to marine ortanisms as a result of OCS oil and gas development activities and the concurrent operation of offshore nuclear plants would occur when the impacts of both activities, although different in nature, affect the same populations. Because the proposed plant is located about 45 miles shoreward of the proposed leasing area, this could occur

primarily as a result of pipeline placement in the same general area as the nuclear plant. Impacts of oil from pipeline breaks or minor chronic pollution from faulty pipelines could affect populations within the impact range of the nuclear plant. Since the thermal discharges often attract some marine organisms, particularly some fish species, greater concentrations of these species could be affected by pipeline-related oil pollution if such pollution occurred in the vicinity of a nuclear plant.

The proposed nuclear facility will require some onshore support facilities in the form of office space, warehousing, and docks for barging equipment and supplies. Atlantic City has been proposed as the area to receive these facilities. If OCS-related onshore facilities were also located in the Atlantic City area, cumulative impact of these activities along with OCS-related activities could cause additional population migration and economic activity in the area. The extent of investments and requirements for nuclear plant support facilities is not known; therefore, the cumulative impact cannot be ascertained with any accuracy. However, it is possible that the added investment onshore could result in more sustained economic activities and population levels which our analysis indicates would not be maintained in an area like Atlantic City as a result of the proposed OCS lease sale solely.

Short-term construction impacts of an offshore nuclear power plant would include localized desstruction of benthic infauna communities, disturbance of bottom sediment, resuspension of bottom materials resulting from dredging, filling, and other construction activities. If construction of such a plant occurred simultaneously with the laying of OCS-related pipeline(s) in the area, cumulative impacts to marine organisms could occur.

4. Ocean Dumping

The use of designated or newly proposed ocean dumpsites will continue through the beginning of the next decade at which time EPA plans to minimize this practice. Given the anticipated level and timing of OCS related operations, ocean dumping would be occurring during the exploration, and possibly, development phase(s). Cumulative impacts could result from pollution loadings and increased marine traffic (Section III.C.4. discusses this in greater detail). Increased numbers of vessels passing through dumping grounds could result in increased vessel-vessel accidents though the chances for oil spills are remote. Although the amounts of drill cuttings, accidentally released drilling muds, and resuspended sediments caused by potential pipeline emplacement would be greatly dwarfed by the amounts of material disposed of by ocean dumping, they would add to the total sediment load in the ocean; of this total, only the small fraction of drilling mud introduced to the marine environment, or

possibly polluted, resuspended sediments (from pipeline burial) could have a cumulative negative impact on marine organisms when added to the loadings caused by ocean dumping.

There has been some concern expressed about the possibility of oil mixing with sewage sludge in the Mid-Atlantic and carrying populations of coliform bacteria to the beaches, thereby infecting human populations.

Normally, coliform bacteria die out rapidly in salt water. The only high concentrations of coliform bacteria found in the ocean occur around sewage outfalls, sewage dumpsites, and ships discharging their sewage.

The coliform family of bacteria is not one of those indicated by recent research as using oil as a growth medium; therefore, there is no possibility that floating oil could generate an explosion of fecal coliform on the beaches even if it were contaminated with the bacteria. It is possible that the oil could "protect" the bacteria and, if other nutrients were also "caught up" in the oil, the bacteria could grow, but no information is available at present to indicate that a great danger of this exists.

Crude oil does not sink in mass, to rise again later, so that it is unlikely that any oil spill would become contaminated from the sewage dumpsites that now exist and then inundate the beaches. Any possibility that exists for some very small percentage of oil spilled to become tar balls, be carried down into the sewage sludge, and then be carried up and onto the shore, exist at the present due to the extensive tankering of foreign crude oil. OCS production would not significantly increase existing levels of tanker traffic.

The reported incidence of tar balls containing sewage sludge with high coliform counts is more likely the result of the discharge from sewage on combined sewer outfalls near shore. These discharges carry both coliform bacteria and heavy and light fractions of oil and are responsible for a much greater percentage of the oil introduced annually to the oceans than are the oil spill accidents (NAS, 1975.) The oil from these outfalls contaminated with bacteria, pesticides, heavy metals, and so on, would be discharged not far from shore and could easily be carried back on the tide. This is a serious contamination problem for many reasons and should be corrected, however, OCS production will have very little if any effect on it.

5. Dredging

If onshore facilities requiring coastal locations and access to vessels were to be located in areas which cannot presently accommodate required drafts (15 feet), channel dredging would be required. Resuspension of bottom sediments, turbidity and destruction of habitat of marine organisms would occur. Dredging would require a permit from the U.S. Army Corps of Engineers. If the proposed dredging was considered to be a major action affecting the environment, an environmental impact statement would be written by the Corps of Engineers prior to making a decision to issue a permit.

If such dredging activities were to take place in an area where pipelines were laid, marine organisms would be subjected to cumulative levels of impacts from bottom disturbance.

## IV. MITIGATING MEASURES INCLUDED IN THE PROPOSED ACTION

The following measures will mitigate some of the possible adverse impacts resulting from this proposed sale. These measures are presented as they relate to the jurisdiction of special agencies as well as to oil spills, offshore structures and pipelines, and other impact-producing activities associated with this proposal.

### A. Federal Regulations and Enforcement

Although many Federal agencies have responsibilities in energy and environmental affairs policy of the United States, only certain ones have direct OCS regulatory and enforcement authority. These include the Bureau of Land Management, U.S. Geological Survey, the Environmental Protection Agency, the U.S. Army Corps of Engineers, the U.S. Coast Guard, the Materials Transportation Bureau, the Federal Aviation Administration, the Federal Power Commission and the U.S. Navy. Following is a discussion of the mitigating measures that are applied by these Federal Government agencies to OCS operations.

#### 1. Department of the Interior

##### a. Bureau of Land Management

The Bureau of Land Management in coordination with other Interior agencies has developed "special stipulations" for this proposed sale which are discussed in Section IV.E. If these proposed stipulations are approved by the Secretary, they will be legally binding on all leases issued as a result of this proposed sale if it is held.

BLM staff at the field level will review operators' actions and reports for compliance with these stipulations, e.g., archeological and biological survey data. In addition, the BLM environmental studies program will provide information which can be used to develop new special stipulations, Notices to Lessees, or changes in the Mid-Atlantic Operating Orders issued by the U.S. Geological Survey over the life of a lease. For example, data collected in the Flower Garden Reef area offshore Texas were used for developing restrictions in certain operating practices.

Most of the stipulations proposed in this draft statement were initially suggested by the BLM; under requirements of Secretarial Order 2974, meetings and discussions were held at the field level between BLM, U.S. Fish and Wildlife Service, and the USGS on the wording and intent of each of the stipulations. When agreement was reached, headquarters offices of each of these agencies in Washington, D.C. were informed and their tentative approval was granted.

The Bureau of Land Management administers regulations governing the granting of rights-of-way for pipelines on the OCS (43 CFR, Subpart 2883). As part of this role, BLM will conduct pipeline corridor management studies in an attempt to determine the most technically and environmentally sound pipeline routings to shore. A study of this nature was begun in the MAFLA sale area in cooperation with coastal States but was discontinued because to-date there have been no discoveries of oil and gas over most of that sale region.

b. U.S. Geological Survey

Regulations governing the safe conduct of mineral operations and development of the OCS are administered by the U.S. Geological Survey. These regulations are contained in Title 30, Part 250 of the Code of Federal Regulations and in the proposed Mid-Atlantic OCS Orders. The proposed Mid-Atlantic Orders 1, 2, 3, 4, 5, 7, and 12, appeared in the Federal Register on December 8, 1975. Public comments on these proposed orders have been reviewed and changes made where applicable. Appendix 11 contains the full text of the revised, proposed Orders, which will be issued in a final form prior to proposed OCS Lease Sale No. 40, should it be held. Changes in the wording of individual Orders from the initial version which appeared in DES OCS Lease Sale No. 40 are also indicated in Appendix 11. Orders 6, 8, 9, 11, 13, 14, and 15, which are associated with the post-exploration or production phase of offshore operations are still undergoing internal review and will be available for public comment shortly after the proposed sale date, but prior to State and Federal review of any development plans. Additional OCS Orders may be prepared and issued and the existing Orders revised as the need occurs throughout OCS operations. In the case of violations, leases are subject to cancellation and lessees are subject to the penalty of the OCS Lands Act.

A general description of operating requirements under the proposed Mid-Atlantic Orders follows. Proposed Orders 6, 8, 9, 11, 13, 14,

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[1]OCS Order No. 10 concerns marine sulfur extraction. No plans are presently under consideration to issue this Order for the Mid-Atlantic.

and 15, consistent with the established numbering sequences for other OCS areas, are also summarized. Significant public comments on the proposed Orders, changes effected, and mitigatory aspects of the Orders are included.

Proposed Mid-Atlantic OCS Operating Order #1

This Order requires all platforms, drilling rigs, drilling ships and wells to have signs of standard specifications for identification of the operator, the specific lease block of operation, and well number. It also requires the marking of all subsea objects which might present a hazard to other areas of the OCS.

Comments received on the initial draft version of this Order indicated a concern that present Coast Guard Regulations do not provide adequate protection in some cases where the use of subsea production well facilities and fishing gear or shipping could be involved in accidents. Consequently, the latest version of this Order (Appendix 11) states that all subsea objects resulting from lease operations which could present such a hazard must be identified by navigational markings, of a design approved by the Supervisor and not inconsistent with applicable U.S. Coast Guard Regulations. Under this provision,[1] the

[1]The wording change has eliminated the need for Special Stipulation #7 which appeared on pages 363-364 of DES for Proposed OCS Lease Sale No. 40.

potential for accidents to subsea production systems, "stubs," fishing gear, and ship anchors is substantially reduced as is the possibility of an oil spill from such an accident. This effectively eliminates impacts which were discussed in Sections III.A.1.b., III.C.1.c., III.C.2.a., and oil spill impacts discussed throughout Chapter III which could result from damage to "stubs" of subsea production systems.

Proposed Mid-Atlantic OCS Operating Order #2

Proposed Order #2 concerns procedures in drilling of wells. It requires the operators to file an application for drilling which includes information on the drilling platform or vessel, casing program, mud program, blowout prevention equipment, well control training and safety training of operators' personnel, and a list or description of critical drilling operations which are or may be performed. The Order then describes certain procedures or equipment to be used in each phase of the drilling operation.

Public comments on the proposed Order indicated concern that a temperature or cement bond well log should not be required if the casing was recemented since this type of well log is not all conclusive and not required under present Gulf of Mexico Operating Orders. This argument was rejected as these logs provide the best available information on placement of new cement and adequacy of formation/casing seals.

Concern was also voiced at the inclusion of a requirement that the District Supervisor may prescribe an additiona' casing string at specific setting depths for wells encountering abnormal pressures or conditions or initial wells in an area; it was felt the Supervisor already could impose this requirement without providing for it in this Order, however, the USGS believes it is best to inform lessees of this requirement in OCS Order #2, and consequently it has been left in.

A concensus of commentors felt that deployment of blind shear rams on blowout preventers for wells drilled on platforms or jackup rigs serves no useful purpose and there is a risk of accidental actuation of these rams under certain conditions; in the latest revision of the proposed Orders, blind shear rams are required additionally only on drillships or semi-submersibles while blind rams are required in addition to other blowout preventers on platforms and jackups.

The need for an automatic control on annular type blowout preventers was questioned as there is no such proven device and it might unduly complicate the control system; this provision has been revised so as to require an alternate control of this type blowout preventer in case the primary controls fail. Pressure testing of annular preventers once a week from each control station was felt unnecessary by some reviewers of the proposed Orders because it causes unnecessary wear on the preventer sealing elements; consequently, the revised Order requires a weekly pressure test though it is not specified that pressure tests be repeated for each control station.

Pressure integrity of the BOP stack can be confirmed from one station and actuation from both stations will prove the controls to be in proper working condition as required under the actuation tests.

Some reviewers felt no need to estimate, for approval of the drilling permit, the minimum amounts of drilling muds needed; however, the USGS believes this allows the operator and the Geological Survey to agree in advance on proposed mud quantities and provide a means to suspend operations when mud supplies are low.

Due to the technical complexity of the proposed Order, not all details are included in describing its mitigatory impact--the reader may refer to Appendix 11 to review the entire Order and Appendix 4 to review offshore oil and gas operations and technology. This proposed Order requires that all drilling platforms and vessels to be used must be capable of withstanding oceanographic and meteorological conditions of the Mid-Atlantic; applications must include all pertinent data on the fitness of the platform or vessel and each such drilling structure must be inspected by the USGS for compliance with OCS Orders. This requirement should eliminate most concerns about the impact of Mid-Atlantic weather, waves, sediment scour, and currents on offshore structures (Sections III.B.3., and III.C.7.). Operators must collect and report oceanographic, meteorological, and performance data of the vessels

and platforms during operations in order to assist in developing future or revised operational guidelines for the Mid-Atlantic.

All wells must be cased and cemented in order to support unconsolidated sediments, prevent leakage of fluids between formations or pressure changes in the well. If there are indications of improper cementing, the well must be recemented and logs run to indicate proper sealing of the well hole walls. The casing design and setting depths are to be based on all engineering and geologic factors including the presence or absence of hydrocarbons, potential hazards, and water depths; additional casing strings may be required if abnormal geopressures are encountered or in initial wells in an area of the Mid-Atlantic. A pressure test is required of all casing strings, except the drive or structural casing, to determine the presence of leaks or inadequate cementing. The use of casing as described in this Order should eliminate potential impacts of fresh water zone contamination (Sections II.A.5., III.B.1.), lost production, or the possibility of accidents caused by improper casing (Section III.B.3.).

Blowout preventers and related well control equipment must be installed, used and tested in a manner necessary to prevent blowouts. A specific number of these preventers must be used in every well and they must include a fail-safe design; dual

control systems, and fail-safe valving on critical lines and outlets. A description of these devices is included in Appendix 4. These devices provide protection against oil spills resulting from blowouts (Section III.A.2., 3., and 4.), and discussions of oil spill impacts (Sections III.B., C., D., and G.).

The characteristics, use, and testing of drilling mud, and the conduct of related drilling procedures shall be such as to prevent the blowout of any well. Sufficient quantities of mud are to be maintained and readily accessible for use at all times to insure proper well control. This part of proposed Order #2 will provide additional protection against possible blowouts (Sections III.A.2., and III.B.3.).

Representatives of the operator will provide on-the-site supervision of drilling operations on a 24-hour basis. A member of the drilling crew on the toolpusher will maintain surveillance of the rig floor continuously from the time drilling operations commence until the well is either completed or abandoned. All supervisory personnel including drillers must be trained in present day methods of well control, and records of the training are to be kept at the well site. Weekly blowout prevention drill exercises are required of all rig personnel. These requirements will also substantially reduce the possibility of blowout or other rig accidents (Section III.A.2.) in all kinds of weather (Section III.C.7.), and provide additional safety margins for all crew members.

Procedures to be followed when drilling operations are undertaken to penetrate reservoirs known or expected to contain hydrogen sulfide gas are now included in U.S. Geological Survey OCS Standard No. 1(GSS-OCS-1), "Safety Requirements for Drilling Operations in a Hydrogen Sulfide Environment." This set of standard operating procedures will assure proper testing and safety of the crew as well as the drilling platform or vessel should $H_2S$ be encountered. Hazards of $H_2S$ (Sections II.A.5. and III.B.3.) are substantially reduced by the institution of these procedures.

Since some operations performed in drilling are more critical than others with respect to well control, fire, explosion, oil spills or other accidents, each operator must file with the Supervisor for approval of a Critical Operations and Curtailment Plan for the lease. This Order includes a test or description of all critical operations which are likely to be conducted. The operator must curtail any such operation and notify the Supervisor. This allows the U.S. Geological Survey to provide either approval of the conduct of the operation or to dispatch personnel to the lease site for observation of the operation. This part of proposed OCS Order #2 will provide additional governmental control over drilling operations which may be hazardous to the drilling platform, vessel, crew, and the environment (Sections III.A.1., 2., 3., 4.; III.B.; III.C.2., 5., 6., 7.).

## Proposed Mid-Atlantic OCS Operating Order #3

This Order is established to provide regulation of plugging and abandonment of wells which have been drilled for oil and gas. Some reviewers of the first version of this proposed Order felt that a requirement that no more than 762 meters (2500 ft) of uncased hole should be left without a 30-meter long (100 ft) cement plug in wells which had required a mud weight in excess of 1.44 $kg/dm^3$ for control was arbitrary; the USGS has left this wording in, however, as it does provide a standard means of sealing off wells which had encountered abnormal pressures. A second criticism concerned the means of testing the strength of the second cement plug below a surface plug--it was felt that a pump pressure test could be substituted for placing a minimum pipe weight of 6800 kg (15,000 lb) on the plug; this suggestion was accepted as a second means of testing the strength of the plug.

For permanent abandonment of wells, cement plugs must be placed so as to extend 30 meters (100 ft) above the top and 30 meters below the bottom of fresh water, oil, and gas zones to prevent those fluids from escaping into other strata. Portions of a well in which abnormal pressures are encountered are also required to be isolated with cement plugs. Plugs are required at the bottom of the deepest casing where an uncased hole exists below. Plugs or cement retainers are required to be placed 30 meters above the top

and 30 meters below any perforation interval of the well hole used for production of oil and gas.

A "surface" plug (46 meters--150 ft long) shall be placed 46 meters or less below the ocean floor. A pressure test must be made of the top plug below the surface plug, spaces between plugs must be filled with drilling muds exceeding the greatest formation pressure encountered in drilling each interval, the casing and piling on the sea floor removed to a depth below the ocean floor approved by the Area Supervisor. For temporary abandonments, plugs and mud must be emplaced with the exception of a surface plug. (The temporary abandoned well would have to be marked in accordance with proposed Order #1.)

This Order should eliminate concern about contamination of fresh water zones (Section III.B.3.) or the possibility of oil and gas leaks from completed wells. The requirement that sea floor above each final abandonment must be cleared, and the removal depth of casing and piling must be examined on a case-by-case basis, will provide protection to navigation and fishery interests (Sections III.A.1.; III.C.1., and 2.); the chance that obstructions might become exposed due to sand wave migration is reduced as well (Sections II.A.5., and III.B.3.).

Proposed Mid-Atlantic OCS Operating Order #4

Proposed Order and refeзenced Order No. 14 provide for extension of a lease beyond its primary term for as long as oil or gas may be produced, and the operator has met the requirements for diligent development.

If these circumstances should occur, a lease can be extended beyond its initial term, pursuant to Section 8 (b)(2) of the OCS Lands Act and Title 30 CFR 250.11 and 250.12 (d)(1).

Comments received on the first draft version of this Order indicated a belief that producibility of an oil well could be determined by electric logs and drill cores. The U.S. Geological Survey maintains that this data only indicates the presence of oil and not if the oil can be produced in commercial quantities, hence a production test of two hours duration or more is to be required.

In addition to a production test for oil, one of similar duration is required for gas. All pertinent engineering, geologic, and economic data is required to support a claim that a well is capable of being produced in commercial quantities. Each test must be witnessed by the U.S. Geological Survey, although under certain circumstances, an operator's affidavit or a third party test may be acceptable. The purpose of this Order is to guarantee that a lease has been found to be capable of producing oil or gas prior to granting an extension on the lease.

Proposed Mid-Atlantic OCS Operating Order #5

This Order sets regulations for the installation, design, testing, operation, and removal of subsurface safety devices. Several reviewers of this proposed Order felt that the wording should be identical to that of Order #5 for the Gulf of Mexico, especially

in the discussions of installation, testing, and reporting on failures of subsurface safety devices. These comments were felt to be unacceptable by the USGS due to the fact that the Mid-Atlantic OCS is a frontier area, and individual requirements should be more stringent for this frontier area than those for the Gulf of Mexico.

Proposed Order #5 requires that all well tubing installations open to hydrocarbon-bearing zones shall be equipped with a surface controlled, subsurface safety device that is placed 30 meters or more below the ocean floor. All wells perforated and completed but not placed on production must be equipped with a subsurface safety device or tubing plug within two days after the well is completed. Subsurface safety devices should also be placed in injection wells unless they are incapable of flowing oil and gas. All safety devices must comply with the minimum standards set forth in the "API Spec. 14A, First Edition, October 1973, Subsurface Safety Valve" and recent supplements as approved by the Area Supervisor. Testing of the device must take place monthly for six months after installation and quarterly thereafter; if it does not operate correctly, it must be promptly removed with a properly operating device put in place and tested. Additional protective equipment is also required with the use of subsurface protective devices. In a case where tubing installations have been opened to hydrocarbon zones and are not

equipped with subsurface safety devices (during workover), the installation must be so identified and such a device or tubing plug must be available at the field location to be emplaced if necessary. Records must be kept of all subsurface safety devices employed at each well with quarterly reports prepared on reasons for any failures of the devices.

This Order provides additional means to prevent blowouts and keep wells under control, thereby reducing risks described in Section III. A.2., and impacts from spills in Sections III.A.3., 4; III.B.1., 2., 3., 4.; III.C.2., 5., 6., and 7.

OCS Operating Order #6

This Order pertains to the development stage of leases and has not yet been released but will be available prior to Federal and State review of development plans. Order #6 sets forth requirements for conducting workover operations and requires all completed wells to have casing heads, wellhead fittings, and valves which are designed for handling pressures exerted by the well. It also requires specific testing procedures for the well. Accordingly, this Order provides for protection of the well during workover and from rupture or loss of oil and/or gas by leakage and thus greatly reduces the possibility of environmental impact from release of oil and gas (Sections III.A., B., and C.).

## Proposed Mid-Atlantic OCS Operating Order #7

Proposed Order # 7 concerns the prevention of pollution to the marine environment and provides regulations for the disposal of waste materials generated as a result of offshore operations.

Some commentors on the initial draft version of the Order asked that a sentence concerning disposal of drilling mud in the ocean be revised so as to state that muds containing "free oil" should not be disposed of into the ocean; this has been done in order to bring the wording into conformance with EPA Regulations. A requirement that operators submit with the Application for Permit to Drill a detailed list of drilling mud components, additives, and concentrations to be used drew many complaints. Most were along the lines that data is not routinely available to operators, would violate the proprietary property rights of the mud supplier, and ranges of materials to be used could vary widely depending on individual drilling conditions. This requirement has been left in since it provides a means of determining the nature of substances to be used, how they should be disposed of, or if they will be allowed to be used. One reviewer of the proposed Order found no reference to drill cuttings other than the fact that cuttings containing free oil should not be disposed of into the water; it was believed that an option to shunt cuttings to the bottom or barge

them away would be helpful in biologically sensitive areas--the U.S. Geological Survey and BLM feel that these contingencies can be (and have previously been) implemented by Special Stipulation or Notice to Lessees and Operators when necessary.

A few comments were received on the reporting of oil spills--that all offshore spills should be reported to governors of affected States, that the Area Supervisor should check with designated State contacts six hours after spills of 15 barrels or more to see if they had been notified, and that spills smaller than 15 barrels should be reported orally to the District Supervisor in 18 hours rather than 12 since the Supervisor might have to be notified at home in some cases. These suggestions were not accepted for the following reasons: the reporting of all small spills would be a burdensome and unproductive exercise for the operator in that potential impact of those spills to states would be negligible, especially given the larger proportion of small spills that occur in State waters but are never reported to State or Federal agencies; the operator is required to contact State officials of spills 15 barrels or more within four hours, to require the Supervisor to check up on their compliance is to indicate no faith--operators who fail to comply with OCS Orders face punitive damages and this should be an effective means of enforced compliance (see the subsection following on enforcement); the need to notify the Supervisor of a "large" spill takes precedence over the fact that he might be at home when it occurs.

A number of reviewers took exception to the necessity of reporting "major" spills (50 barrels or more) to EPA or the Coast Guard, especially since present Coast Guard regulations only require notification of spills 12 miles from shore and EPA has no such requirement; it was felt, however, that because of the responsibilities of these two agencies in oil spill cleanup or monitoring, spill reports would be useful. One commenter asked that operators be required to report observations of pollution or equipment malfunction to the Oil and Gas Supervisor. This was accepted in a modified form, operators being required to notify each other of that occurrence--this would speed cleanup or equipment repair while operators would still be required to report the occurrence under OCS Orders. Finally, one commenter disliked the requirement for monthly inspection of oil spill containment equipment; however, the USGS believes a monthly requirement to not be unreasonable and sets a uniform schedule for such inspections.

Proposed OCS Order #7 sets forth a means to effectively deal with pollution of the marine environment from offshore petroleum operations. It states that the operator must prevent pollution of the ocean and that the disposal of waste products must not create conditions that can "adversely affect the public health, life or property, aquatic life or wildlife, recreation, navigation or other uses of the ocean." As stated above, the operator must submit a list of drilling mud constituents, additives, and concentrations

expected to be used--this provides a means to prohibit or alter the disposal and use of specific components which might be harmful to the environment. Muds containing free oil will not be disposed of into the ocean and toxic substances must be neutralized prior to disposal. These requirements in effect eliminate the potential impacts discussed in Sections III.A.1., III.B.1. and 2., and III.C.2., concerning this topic. Discharges from the rig must meet EPA standards--reducing impacts to marine water quality (III.B.1.).

No cuttings, sand or other solids containing free oil are to be disposed of into the ocean unless the oil is removed, thus eliminating potential impacts to water quality and marine organisms caused by such introduction of oil to the marine environment (Sections III.A.1., 3., III.B.1.2., and III.C.2.). No solid waste materials or debris can be disposed of in the marine environment but must be incinerated or transported to shore for disposal according to governmental regulations; this requirement eliminates potential impacts to fisheries (Sections III.A.1., III.C.2.).

All personnel must be thoroughly instructed in the prevention of pollution from offshore operations. Rigorous inspection schedules are required for all facilities. Pollution reports are necessary for all oil spills with notification of proper authorities. Standby pollution control equipment must be maintained or available to each operator. The equipment must include booms, skimmers, cleanup materials, and chemical agents (though chemical agents can only be used with the express consent of the Supervisor) and it must be

inspected monthly with proper maintenance. Results of inspections of this equipment must be recorded. Any application for a drilling permit must include an oil spill contingency plan with provisions for varying degrees of response effort depending on severity of oil spill; identification of containment and cleanup equipment availability; notification procedures of responsible persons and alternates in the eventuality of a spill; and provision for specific actions to be taken after discovery and notification of an oil discharge. Should a spill occur, immediate corrective action must be taken. This portion of the Order provides the maximum protection available for the prevention and cleanup of oil spills. It provides substantial reduction in the potential impact of oil spills as discussed in Chapter III.

OCS Operating Order #8

Although no draft version of this Order has been released for the Mid-Atlantic, it will be available for State and Federal review prior to the submission of any operator development plans. Order #8 provides approval procedures for the installation and operation of platforms, fixed and mobile structures, and artificial islands to be used for production of offshore oil and gas. Safety procedures and pollution control equipment requirements are also set forth. This Order will provide controls for prevention of pollution impacts set forth in Sections III.A., B., and C., and the selection of safe production designs for conditions of the Mid-Atlantic OCS (Sections III.A.1., III.B.3., III.C.1., 2., 3., 4., and 7.

OCS Operating Order #9

This Order will also be available for Federal and State review prior to submission of operator development plans. Order #9 provides approval procedures for pipelines. Information to be submitted for the approval will include the purpose of each line, proposed route, water depths, capacity, operating pressures, size and grade of pipe, burial depth, corrosion protection, protective coating, connecting and metering facilities, and pressure control facilities. The methods of welding and laying the pipeline are to be monitored, as is the installation of connecting facilities. A hydrostatic test to greater than the designed working pressure of the line will be made upon completion of installation.

Agreements to be made shortly between the Materials Transportation Bureau and the USGS will provide better coordination of their agencies in development of pipeline standards and monitoring.

The effect of this Order is to greatly reduce the chance for offshore oil spills or gas leaks as discussed in Section III. The approval of pipeline routes by the USGS as well as BLM and the Department of Transportaion (described elsewhere) can effectively reduce a variety of impacts to marine biota and multiple uses of the Mid-Atlantic OCS.

OCS Operating Order #11

As in the case of Orders 6, 8, and 9 (above), Order #11 will be available before development plans are submitted. It provides for the

prevention of waste, conservation of oil and gas, and protection of correlative rights. Enhanced recovery of all oil and gas from a lease will be required and production rates of oil and gas will be established. It will also state that each operator shall produce without waste his proper share of oil and gas from a common source of supply. Production procedures to be followed in the eventuality of shutins for overproduction or storms will be set forth as will requirements for all tests of well producibility. Requirements concerning the location of all wells will be given as will the ability of the Supervisor to decide issues on field unitization presented.

Therefore, this Order will provide a means to insure proper production of oil and gas and placement of facilities to maximize production while minimizing environmental impact. This provides control on impacts described in Sections III.A.1., III.C., and III.D.1.

Proposed Mid-Atlantic OCS Order #12

This proposed Order sets forth requirements for public availability of data and records concerning offshore petroleum operations. A number of reviewers of the initial version of the proposed Order identified lines and tubing records and the location of a well at the proposed producing zone as being confidential information meeting the criteria of the Department of the Interior. Consequently, these items have been included in the revised Order. A request was accepted to bring this proposed Order

into conformance with the similar Pacific OCS Orders; this was accomplished by changing the five-year period after the cessation of production and public release of data (minus information on porous zones and geologic markers) to exclude from that period of time suspensions directed by the Department or as a result of court order. Questions on the availability to State geologists of well information considered to be proprietary will be resolved shortly.

Several of the Mid-Atlantic States expressed a desire to have information and records provided to them for all OCS activities. Under the Order, specific types of information, data and records pertaining to production, operations, well tests, sales of lease production, accidents, inspection, and pollution incidents are to be available for public inspection. However, privileged information such as geological and geophysical information would not, at least for a period of time, be made available for public inspection.

OCS Operating Order #13

This Order as well as 14 and 15, have not yet been issued for the Mid-Atlantic OCS. They will be issued before any development plans are submitted for review and approval. Order #13 will require the accurate measurement of oil and gas production and set forth stipulations under which production from several wells can be commingled. Standards will also be set for meters to be used in measuring production. This Order will offset any possible attempts

of fraud and alleviate public concerns that operators are underestimating royalties due the Federal government.

OCS Operating Order #14

Order #14 will assure diligence in the development of OCS natural resources by allowing limited suspensions of operations or production while the operator is waiting for installation of equipment or granting of permits necessary for transportation of oil and gas from a lease. Criteria will be set under which suspensions can be granted and will provide a means to determine if production is being withheld for purposes other than as stated. A proposed version of this Order issued on December 19, 1975, is included in Appendix 11.

OCS Operating Order #15

Order #15 on the submittal of information for development plans, pursuant to the new requirements established in 30 CFR 250.34 in November 1975,[1] will detail the required data contents and the review process to be followed before the Supervisor grants approval of the development plan(s) of each lessee. The lessee will submit the information to the directly affected states concerning information on the proposed onshore and offshore facilities anticipated for development. This information may be submitted simultaneously to the States with the formal development plan(s).

There is presently a Task Force consisting of Department of the

[1] See Appendix 12

Interior personnel and representatives from each of the five regions of the OCS Advisory Board, which is working on more detailed guidelines for this Order.

## Inspection Programs and Approval Requirements

To enforce the Geological Survey Operating Regulations (30 CFR 250) and OCS Orders, a comprehensive inspection system has been developed. OCS operators must receive approval before commencing any work. Operators are required to submit a notice and detailed description of work they desire to perform to the USGS District Supervisor. This requirement is to insure that no operation is conducted without thorough planning for safety, conservation, and protection of the environment, and to determine that all operations meet the standards established by regulations and OCS Orders.

## On-Site Inspections

All operations, regardless of the activity, will receive regular on-site inspection for compliance with regulations and OCS Orders. The Geological Survey uses a systematic program including both scheduled and unannounced inspections to assure the achievement of safety objectives.

Floating drilling vessels or drilling units will receive a detailed inspection to insure conformance with regulations and OCS Orders before commencement of drilling operations. These predrilling inspections are comprehensive and often require several days to complete. Also, these rigs will be inspected at least once during the drilling of a well, and all well control, safety, and pollution control equipment will be inspected for proper function.

Permission to either abandon or suspend a well must be granted by the USGS; this includes the setting of all required cement plugs, the cutting of the several casing strings below the sea floor, and the removal of all subsea equipment. The depth below the sea floor at which the casing is removed will be reviewed by the USGS on a case-by-case basis to ensure that sediment migration will not eventually expose the plug (proposed Mid-Atlantic OCS Order 3).

Well workover and well abandonment phases of OCS operations, as with drilling, will receive both scheduled and unscheduled inspections, depending on the progress of a particular operation. Drill stem testing, cement plugs set prior to redrilling a well, cement plugs set to temporarily or permanently abandon a well, and all casing cementing operations must be approved by the USGS Supervisor.

OCS pipelines will be installed in accordance with proposed Mid-Atlantic OCS Order No. 9, which will provide for submittal of information such as purpose of each line, proposed route, water depths, capacity, operating pressures, size and grade of pipe, burial depth, corrosion protection, protective coating, connecting and metering facilities, and

pressure control facilities. The methods of welding and laying the pipeline are monitored, as in the installation of connecting facilities. A hydrostatic test to greater than the designed working pressure of the line is made upon completion of installation.

Inspection Schedule and Enforcement

The inspection program for the Mid-Atlantic OCS area will be maintained by the U.S. Geological Survey with the intent that required regulations will be followed to avoid potential hazards to personnel, provide protection for the environment, and preserve the multiple-use concept of the OCS lands. Warnings for incidents of noncompliance are issued and the date of correction of defects will be recorded.

The Geological Survey anticipates that a temporary district office will be established to oversee and inspect the initial industry exploratory activities in this Mid-Atlantic area. This office would report to and be supported (technically and administratively) by the existing Office of the Eastern Area Oil and Gas Supervisor in the Conservation Division of the USGS. The location of the district office would be contingent upon two primary logistic considerations, i.e., proximity to the concentration of exploratory operations and to the adequate helicopter service areas. Initially, the district office would be expected to be staffed with a district supervisor, one petroleum engineer (drilling), three petroleum engineering technicians (inspectors), and one office clerk-typist. This initial staffing would be expanded concurrent with increases in the level of activities and if the exploratory phase matures into actual development and production operations in the area, in the event the sale is held.

Visual inspections of the water surface over OCS pipelines in other operating areas are currently made by the operator for evidence of failures and leaks. USGS and operator personnel in those areas visit production facilities daily and follow a route approximating the pipeline route. Although no specific inspection schedule has been established for this Mid-Atlantic area to-date, the USGS will assure that thorough and frequent inspections will be carried out in this proposed sale area. Such a schedule will be developed concurrently with the initial phases of exploration, and will continue through the life of the field.

The U.S. Coast Guard also patrols for oil spills or leaks with vessels and aircraft. No specific schedule has been developed for the Mid-Atlantic area to-date, however, in the event the sale is held the Coast Guard is expected to develop a schedule commensurate with the level of activities within the area.

A routine schedule for external inspection by operators of marine pipelines, for evidence of failures and leaks, including risers to the platforms, will be required for the Mid-Atlantic OCS area.

An approved contingency plan is required from each operator in the area that will include spill control, containment and cleanup, and measures to be taken if there is any likelihood that hydrogen sulfide gas might be encountered during the drilling operation.

## Inspection Procedures for Subsea Systems

Subsea systems may possibly be used to produce oil and gas resulting from this proposed sale. Inspections of these systems in the Mid-Atlantic will be in accordance with the proposed OCS Orders. A new OCS Order especially designed for subsea systems is presently being considered. Proposed Order #1 requires the surface marking of all such systems in accordance with guidelines developed by the USGS Supervisor.

The many Federal agencies involved in the review process of subsea systems include in addition to the Geological Survey: EPA, Coast Guard, Corps of Engineers, U.S. Fish and Wildlife Service, and the Bureau of Land Management. Except for proprietary parts, plans for exploration and development utilization are available for general public review.

## Operator Reports

A comprehensive reporting system covering all oil spills and any unusual conditions (for example, reporting and investigation of a persistent oil slick from an unknown source, such as a sunken ship or natural oil seep) is to be required by the proposed OCS Orders, and is a key factor in monitoring operations in the Mid-Atlantic area. Operators are also required to maintain records for inspection by the Geological Survey of required periodic tests of safety equipment. A digest of these operator reports and the various forms that are required can be found in the proposed Mid-Atlantic OCS Order No. 12, in Appendix 11.

## Requirements Specific to Mid-Atlantic Operations

Specially tailored requirements for the Mid-Atlantic under the proposed OCS Orders are discussed below.

Proposed Order #1 requires that all subsea structures (be they temporarily abandoned wells or subsea production systems) shall be marked on the ocean surface in accordance with guidelines developed and approved by the Supervisor and other Federal regulations. This will provide a means to reduce potential damage to fisheries gear or petroleum production equipment as a result of accidents.

Reports on all encountered oceanographic and meteorological conditions encountered by drilling structures and the performance of the structures will be required of all offshore operators in the Mid-Atlantic OCS.

Proposed Order No. 2 specifies that casing will meet API standards. In addition, cross referenced in proposed Orders Nos. 2 and 7 is approval by the USGS of the mud program before drilling; all substances in the muds to be used must be identified and their use must comply with EPA standards under the Federal Water Pollution Control Act, as amended. No direct ocean disposal of oil-based drilling muds

will be allowed in the Mid-Atlantic, and any request for variance must be reviewed on a case-by-case basis. Although there is no indication of the potential for encountering hydrogen sulfide, safety procedures, equipment, and warning devices will be necessary on offshore drilling rigs and platforms.

As described earlier in this section, casing removal depths will be looked at individually under proposed OCS Order No. 3. To determine whether or not a lease can be extended beyond five years due to discovery of petroleum, an actual production test must be run and all economic, geologic, and engineering data must be supplied to the USGS Supervisor (proposed OCS Order No. 4).

In addition to no direct ocean disposal of oil-based drilling muds, under proposed Order No. 7, no cuttings containing oil can be disposed of at sea; instead, these cuttings must either be washed to remove the oil, with the wash water shipped ashore, or the unwashed cuttings with oil must

be shipped ashore. Both methods will be dealt with by applicable State or EPA regulations. All produced formation water must be treated to meet appropriate EPA water quality standards prior to discharge at sea. Copies of all analyses done on produced formation waters must be sent to the USGS Supervisor and EPA. Oil spill containment equipment must be available to the operator; monthly inspections of this equipment will be performed by the USGS.

Under new procedures for State consideration of OCS oil and gas development plans,[1] the operator must supply a description of all onshore and offshore facilities and operations which are anticipated, plus other pertinent information regarding these developments, to the Governors of directly affected States 30 days before a formal development plan is submitted to the USGS Supervisor. The States will then have 60 days to review this data to determine its adequacy and comment on it. The Director of the USGS can then further delay development at the States' request until necessary information is provided to the States. In addition, a copy of the development plan (minus proprietary data) is also submitted to the Governors of directly affected States at the same time the entire development plan is submitted to the USGS Supervisor. The States have 60 days to review and comment on the submitted plan. This information provided to the States can be used by State agencies to prepare for any environmental and socio-economic impacts which might result from development; they also are afforded, through the Governors, an opportunity to comment or criticize the anticipated development plans.

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[1] Federal Register, 40 (179): 42559-42560; 40 (182): 43036; and 40 (213): 51199-51200. **See Appendix 12.**

Enforcement

The USGS policy is intended to eliminate any noncompliance with lease requirements by the operator that may lead to loss of life, loss of property and resources, or damage to the environment. A standardized compilation of items has been prepared by the USGS, entitled "List of Potential Items of Noncompliance and Enforcement Action," the "PING" list, which is used for inspections. During an inspection of drilling and production operations, depending on the hazard presented toward safety or pollution, either a written warning will be given that allows the operator seven days to correct the incident of noncompliance (INC), or a shut-in order will be issued. The shut-in order may be applied only to the equipment affected by the incident of noncompliance (INC), such as a particular piece of production equipment or a producing zone, or to the entire drilling rig, production platform, or onshore facility, as required.

Additional penalties for noncompliance are specified in Sec. 5(a)(2) of the Outer Continental Shelf Lands Act of 1953, 43 U.S.C. Sec. 1334(a)(2).

> Any person who knowingly and willfully violates any rule or regulation prescribed by the Secretary for the prevention of waste, the conservation of natural resources, or the protection of correlative rights shall be deemed guilty of a misdemeanor and punishment by a fine of not more than $2,000 or by imprisonment, and each day of the violation shall be deemed a separate offense.

Also, Sections 5(b)(1) and 5(b)(2) provide for cancellation by notice of nonproducing leases subject to judicial review or appropriate judicial proceedings.

2. Department of Transportation

a. U.S. Coast Guard

The OCS Lands Act delegates to the Coast Guard the authority to promulgate and enforce regulations covering warning devices, safety equipment, and other matters related to the promotion of safety of life and property on fixed OCS platforms and drilling vessels. The implementing regulations for this delegation are contained in Title 33 of the Code of Federal Regulations, Part 67 and Subchapter N, Parts 140 to 147. Other Coast Guard regulations cover safety equipment on all types of offshore facilities and vessels, specific personnel licensing procedures, and minimum levels for ships and boats, and prohibit the discharge of pollutants from all vessels.

Lead Coast Guard responsibility resulting from this proposed lease sale will be undertaken by the Third Coast Guard District (New York) since all of the proposed tracts are contained in their jurisdiction. Certification of vessels (both boats and rigs) will depend on most recent certification date and operations port. If a vessel operates out of ports in Maryland or Virginia, it may have to be certified by the Fifth District Headquarters (Portsmouth, Virginia). The Coast

Guard's responsibility as to oil spill containment and cleanup is discussed under the heading "Contingency Plans" later in this section. A Memorandum of Understanding between the U.S. Geological Survey and the U.S. Coast Guard is also discussed. No Coast Guard surveillance program for oil spills emanating from rigs, platforms, or pipelines have been developed yet for the Mid-Atlantic although oil pollution and law enforcement patrols by Coast Guard aircraft cover this area to a limited extent. It can be expected that with OCS development and the recent enactment of a 200-mile limit fisheries management law, that patrols will be expanded.[1]

As standard procedure, the Army Corps of Engineers will request comments from the Coast Guard on the placement of offshore rigs and platforms with respect to interference with navigation. Though no specific regulations are in force, the Corps of Engineers generally does not allow structures to be placed within traffic lanes as identified by the Coast Guard. Appendix 7 and Visual 1 give the locations of existing traffic lanes.

b. Materials Transportation Bureau

The Office of Pipeline Safety Operations within the Materials Transportation Bureau supervises safety of gas and oil pipelines including the establishment of design criteria for pipeline systems on the OCS. The Department of Transportation is authorized under the Natural Gas Pipeline Safety Action of 1968 (49 U.S.C. Secs. 1671, et seq.) to establish gas pipeline

[1]U.S. Coast Guard, Written Testimony, Public Hearing, DES for Proposed OCS Lease Sale No. 40, 1976.

safety standards for transportation of gas and for pipeline facilities. Gathering, transmission or distribution by pipeline or storage in or affecting interstate or foreign commerce is included in the meaning of transportation of gas. The Secretary of Transportation is authorized to advise, assist and cooperate with other federal departments in the planning and development of the standards and in methods for inspecting and testing to determine compliance with the standards. Regulations implementing the Department's authority for gas and oil pipelines are found in 49 CFR Parts 192 and 195. Recently proposed regulations by the MTB will more clearly delineate criteria for safety standards for offshore liquid pipelines (including burial depths and marking of pipeline risers) (40 Federal Register 43740), and for offshore natural and other gas pipelines (40 Federal Register 45192). New regulations were also issued in 1975 (Federal Register 40, #91, May 9, 1975) requiring odorizating of gas transmission lines by class location (class determined by population in the area).

c. Federal Aviation Administration

The Federal Aviation Administration is responsible for the monitoring and control of aircraft flights, training of operators, and certification of general operations (Federal Aviation Act of 1958). Flight plans must be filed for all flights which take place in defense warning zones over the OCS (General Operations and Flight Rules, Part 91, Subpart B; Part 121, Subpart U; Part 135, Supplemental Rules). Individual flights through the defense operating

areas must also be cleared with the Commander, Eastern Sea Frontier (U.S. Navy). The FAA office in charge of certifying of operators, training programs, and aircraft will depend on where the operator is based in the Mid-Atlantic and the size of the aircraft that will be used.

3. United States Army Corps of Engineers

The OCS Lands Act provides that the authority of the Secretary of the Army to prevent obstruction to navigation in the navigable waters of the United States is extended to structures located in the OCS. The Corps of Engineers implements this delegated authority by issuing navigational permits for exploration drilling vessels and fixed and mobile platforms according to 33 CFR 209.120 as amended in the July 25, 1975 Federal Register, pages 31320 et seq. In the event this proposed sale is held permits will be processed by either the New York, Philadelphia or Baltimore District Office, depending on the location of the proposed structures. In evaluating the permit application, Corps of Engineers officials will consider the following policies (from 33 CFR 209.120):

> Artificial islands and fixed structures located on the outer continental shelf are subject to the standard permit procedures of this regulation. Where the islands or structures are to be constructed on lands which are under mineral lease from the Bureau of Land Management, Department of the Interior, that agency, in cooperation with other Federal agencies, fully evaluates the potential effect of the leasing program on the total environment. Accordingly, the decision whether to issue a permit on lands which are under mineral lease from the Department of the Interior will be limited to an evaluation of the impact of the proposed work on navigation and national security. The public notice will so identify the criteria.

4. United States Navy

Although not involved in OCS petroleum operations and regulation, the Commander, Eastern Sea Frontier (Brooklyn, New York) controls military air and sea operations in the area. Because access to air space over much of the Mid-Atlantic OCS is restricted due to reasons of national defense (and for reasons of safety), helicopter and aircraft operations in support of petroleum activities must be certified by the Commander in order to take place in certain corridors.

5. U.S. Environmental Protection Agency

Produced waste water is an unavoidable consequence of producing oil and gas. Presently the Environmental Protection Agency, the Geological Survey, and offshore operators in other OCS operating areas are in the process of determining the best method from an environmental protection standpoint, of treating and disposing of produced waste water. The Federal Water Pollution Control Act Amendments of 1972 (P.L. 92-550; 86 Stat. 816, hereinafter the Act), makes the discharge of any pollutant by any person, except in compliance with certain sections of the Act, unlawful. A National Pollutant Discharge Elimination System (hereinafter NPDES) was created by Section 402, and made applicable to discharges into the territorial sea, the waters of the contiguous zone, or the oceans by Section 403. Permits for discharges will be issued by the Administrator (Environmental Protection Agency) in compliance with

guidelines promulgated by him. While the NPDES appears to apply to fixed platforms and structures, it does not apply to 1) the addition of any pollutant to the waters of the contiguous zone or the ocean from any vessel or floating craft, or 2) water, gas, or other material which is injected into a well to facilitate production of oil or gas, or water derived in association with oil or gas production and disposed of in a well. Regulations governing the NPDES may be found in 40 CFP, Part 125, 38 Federal Register 13528 (1973), and the guidelines issued pursuant to Section 403 (c) of the Act are found in 40 CFR, Part 227; 38 Federal Register 12872 (1973); 40 CFR, Part 435; 40 Federal Register 42572 and 42543. Subsurface injection into OCS platform wells is in accordance with Environmental Protection Agency suggested guidelines and is subject to Geological Survey approval and regulation.

EPA offices involved as a result of this proposed sale would be Region II (New York) and Region III (Philadelphia). No regular program for analysis of platform or rig discharges has been developed for the Mid-Atlantic yet.

6. Federal Power Commission

The Federal Power Commission (FPC) grants certificates of public convenience and safety for gas pipelines. In making a decision regarding the granting of such certificates, if considered necessary, FPC prepares environmental impact statements. Both FPC and the Materials Transportation Bureau must approve these pipeline designs. The FPC also regulates gas prices, purchases, and sales (interstate).

B. State Regulation

1. Delaware

Delaware is into the second year of its planning effort under the Coastal Zone Management Act. Under the present schedule, the third and final year of the planning effort should be accomplished by July 1977, and if plans are approved, Delaware would then be eligible for implementation grants.

Existing state legislation already provides a large measure of state control over the coastal zone in Delaware. The Delaware Coastal Zone Act prohibits heavy industry in the coastal zone and establishes a permitting system for defining industrial and other uses. In addition, the Wetlands Act provides further control over uses of wetland areas. Zoning and subdivision authority in all areas of the state is granted to counties for unincorporated areas and to municipalities.

Delaware has EPA approved implementation plans under both the Clean Air Act and the Federal Water Pollution Control Act. Under these plans, the state administers permitting systems for new and remodelled facilities which would result in emissions or discharges of effluents into the air or water systems.

2. Maryland

Maryland is currently in the second year of its coastal zone planning effort, begun in June 1974. Under the existing schedule, Maryland should be ready for implementation of a resultant plan by June 1977.

An Act passed this year, the Coastal Facilities Review Act, gives the state control over facility siting in the coastal zone. Facilities, under the Act, have been defined to include most OCS-related onshore facilities, including support bases over 25 acres. Concurrence of local government is required for permit approval, as are impact statements. Oil handling facilities also require permits granted after oil spill prevention and control programs for such facilities have been approved as adequate. The state also has wetlands legislation establishing a permitting procedure for developments in wetland areas.

The State has an Environmental Protection Act requiring impact statements for state or state-regulated projects. Approved implementation plans under both the Clean Air Act and the Federal Water

Pollution Control Act are in effect in Maryland. Under these Acts, the state administers a permitting system for facilities discharging effluents or emissions into the air or water.

Planning and zoning authority is by state law granted to municipalities and to counties for unincorporated areas.

3. New Jersey

New Jersey began its second year planning effort under the Coastal Zone Management Act in June 1975. If the present schedule is adhered to, New Jersey should be ready to implement its resultant plan by June 1977.

At the present time, the state exerts control over the siting of specified facilities in a narrowly defined coastal zone under its Coastal Area Facility Review Act. The facilities defined by the Act, which requires a permit from the Department of Environmental Protection, are quite inclusive, including manufacturing, industry, and energy-producing facilities as well as housing developments over 25 units, bulk storage, handling and transfer facilities for oil and gas (except on processing or refining plant premises) and others. In addition, a permitting system is established controlling development in wetland areas under the Wetlands Act.

While New Jersey has an EPA approved implementation plan under the Clean Air Act and administers a permitting system for regulating

emissions from new facilities and those undergoing major remodelling or expansions, it does not have an approved implementation plan under the Federal Water Pollution Control Plan. The U.S. Environmental Protection Agency currently administers a permitting system under that law for effluent discharge to New Jersey.

Under New Jersey law, zoning and subdivision authority is granted to municipalities.

4. New York

New York began the first year of its coastal zone management planning effort in November 1974. If these efforts proceed according to schedule, the state should be ready for implementation of coastal zone plans by November 1977.

Some state control is now exerted in some parts of the coastal zone under the Tidal Wetland Act which regulates development in wetland areas. New York is also in the final stages of implementing a new State Environmental Quality Review Act requiring impact statements for projects under State jurisdiction.

New York administers a permitting system for facilities generating air emissions, under the Clean Air Act. It has an approved

implementation plan for effluent discharges under the Federal Water Pollution Control Act. The U.S. Environmental Protection Agency administers a permitting system for New York under that Act.

New York state law grants zoning and subdivision control to municipalities.

5. Virginia

In October 1975, Virginia will complete its first year coastal zone planning effort. By October 1977, the Commonwealth should be able to implement resultant plans under the Coastal Zone Management Act if the schedule is met.

Currently, some state control is exercised in the coastal area through the Wetlands Act, which requires permits for development in wetland areas. In addition, the state has laws regulating uses of subsea areas. The State also has an environmental quality act which requires impact statements for state sponsored or regulated projects.

Virginia administers permitting systems for facilities discharging effluents or emissions into the air or water. These plans are approved by EPA and emanate from the Clean Air Act and the Federal Water Pollution Control Act.

Zoning and subdivision controls have been delegated to municipalities and to counties for unincorporated areas.

C. Oil Spill Containment and Cleanup

At this time, the only Federal regulations applying to oil spill prevention, containment and cleanup between the 12-mile contiguous zone and the 200-mile economic zone, within which BLM is proposing tracts for oil and gas development, are stipulations attached as a condition of leases, and OCS Operating Order #7. That Order is discussed below in subsection C.4. Federal pollution plans which would apply within the 12-mile limit are described below. If jurisdiction were to be extended beyond 12 miles, it is assumed that the current Federal pollution plans would be similarly applied beyond the 12-mile limit.

1. National Oil and Hazardous Substances Pollution Contingency Plan[1]

The National Contingency Plan developed in accordance with the Federal Water Pollution Control Act as amended, P.L. 92-500, provides a pattern for coordinated and integrated responses by Federal agencies to oil spills and promotes the coordination of Federal and state response systems. The National Plan sets up a system for the development of regional plans and includes the resultant regional plans. Primary operational responsibilities are divided between the Coast Guard and EPA. The Coast Guard has responsbility for spills in coastal waters as defined in each regional Oil Pollution Contingency Plan. EPA has responsibility for inland waters.

Within each region, the Coast Guard has designated an On-Scene Coordinator (OSC). Additionally, Regional Response Teams (RRT's) have been set up. The RRT is activated in the event of a major spill and serves as a technical advisory board to the local OSC. In the event of a spill, the OSC makes a determination as to whether or not the responsible party is able and willing to adequately combat the spill. Affected States are invited to participate in the deliberation. In the event that the responsible party is deemed to be taking adequate corrective action, the OSC maintains a coordinating function. If it is determined that an adequate response cannot or will not be made by the responsible party, the OSC becomes an On-Scene Commander and cleanup activities are then taken over by the U.S. Coast Guard or the EPA for inland waters. Each of these agencies maintains Regional Response Centers where equipment and/or communications are located. In addition, the Coast Guard maintains a strike force on each coast which handles major spills and harbors most major cleanup equipment.

The Mid-Atlantic includes two regional plans administered by EPA: (1) Region II, headquartered in New York City and including New York and New Jersey, and (2) Region III, headquartered in Philadelphia and including Delaware, Pennsylvania, Maryland, and Virginia. Regional Response Centers are located in Edison, New Jersey, and Philadelphia, Pennsylvania. The regional organization is further broken down into subregions consisting of the individual states.

Two Coast Guard Districts have responsibility for the Mid-Atlantic Region. District 3, at Governor's Island in New York City, covers New York, New Jersey, Pennsylvania, and Delaware, and District 5, at Portsmouth, Virginia, covers Maryland and Virginia. Regional Response Centers are located at Governor's Island and Portsmouth, Virginia. In general, OSC responsibilities have been delegated by

the Districts to Captains of the Ports. The Atlantic Strike Force of the Coast Guard is located at Elizabeth City, North Carolina. The districts rely on the Strike Force equipment for major offshore spills. Table IV-1 is a list of equipment maintained by the Atlantic Strike Force.

Use of dispersants for oil spills is also regulated under the national and regional plans. Data on dispersants which might be used must be provided to EPA which can then advise OSC's regarding their use. Use of dispersants in Regions II and III in inland waters is considered only in extreme fire hazard conditions, particularly when considering use directly onto water bodies. The Coast Guard Districts discourage and/or prohibit the use of chemical dispersants. Use of dispersants under the plan is, in all cases, at the discretion of the OSC's who must consider hazards to human life, toxic effects on other organisms, as well as the effectiveness of other methods before approving their use.

2. State Programs

All Mid-Atlantic States have pollution laws requiring permits for discharge of oil and other hazardous substances and creating fines or liability provisions in the event of unauthorized discharges or spills.

Delaware, New Jersey, and Virginia are presently writing or updating oil spill contingency plans, which become annexes to the regional plans of the Federal agencies. In general, state plans compliment

Table IV- 1.

ATLANTIC STRIKE FORCE
POLLUTION CONTAINMENT AND RECOVERY EQUIPMENT

Air Deliverable Anti-Pollution Transfer System (ADAPTS)--consisting of a prime mover, submersible pump, tripod and rigging gear, fuel cell, transfer hoses, etc.; 2 systems--3 ADAPTS I systems and 4 ADAPTS II systems designed for helicopter delivery.

High Seas Containment Barrier--designed to contain oil in 4 to 6 ft seas, 2 kt current and 20 mph winds, transportable by helicopter or barge, requires 40' to 44' tow vessel and 4 personnel to deply, total on hand, 4284 feet.

High Sea Oil Recovery Systems: Oceans Systems, Inc.--designed to recover 90 percent plus of oil in 8 ft seas, 3 kt current and 40 kt wind, 2000 GPM capacity, requires 2 tow vessels, 1 holding barge and 120 man hours (6 personnel) to assemble.

Lockheed Disc-Drum Recovery System--designed to recover 90 percent plus of oil in 6 ft seas, 2 kt currents and 20 kt winds. 1000 GPM capacity, require tow vessel holding/separating barge and 15-man hours (4 personnel) to assemble.

Mobil Command Post (31' mobil home): Small Spill Response Systems--Ocean Systems, Inc., 125 GPM capacity, (2) slurp skimmers, (2) Coast Guard designed skimmer heads, JBF Trailerized skimmer.

Table IV- 1. Continued.

Commercial Booms

400', 36" Keptner Sea Curtain

200', 12" Slick Bar

360', 36" Coastal Boom

Modular (Pontoon-type) Barge

(4) Boston Whalers and Utility Boats (13' to 21')

(10) Assault Boats (18')

Inflatable rubber boats, outboard motors, welders, compressors, generators, fenders, chemical protective equipment, tools and fittings, diving and salvage equipment, utility trailer.

regional plans and Federal or private equipment is relied upon in most instances, although sorbent material is stockpiled by some states. Both New York and New Jersey have proposed legislation and/or codes of regulation dealing with oil handling facilities and oil spill prevention and contingency plans. Bonding requirements could be imposed on oil handling facilities under existing law in New Jersey, but have not been evoked to date.

Within the region, only Maryland has a fully integrated program which goes beyond coordination of spill responses. Oil spill prevention mechanisms and programs are required in order to obtain necessary permits for oil handling facilities in Maryland. Evidence of fiscal responsibility is required for all vessels involved in the transfer of oil. In the event of a spill, state personnel monitor cleanup progress, advise and direct actions, and collect data for enforcement actions. The state assumes the cleanup activity if necessary and obtains equipment from various state and Federal agencies or the private sector. The program is administered by the Maryland Department of Natural Resources, Water Resources Administration.

New York State has some cleanup capabilities for spills in inland waters. Regional units for spill responses are set up and administered by the New York Department of Environmental Conservation.

Existing facilities and legislation in the states are designed primarily to respond to spills on inland waters or embayments, from refineries, pipelines, terminals or tankers near shore. Since many of the Mid-Atlantic states are updating their contingency plans and considering new legislation, more stringent requirements for oil handling facilities, increased or broadened liability, and more sophisticated and integrated spill response equipment and mechanisms may be in existence in the near future. Information concerning proposed legislation or requirements is unavailable, although it is understood that such changes have been proposed in some states. At this time there is a general reliance on the Federal and private sectors, with states most active in enforcement activities.

3. Existing and Proposed Private Oil Spill and Containment Capabilities in the Region

Both the New York Harbor area and the Delaware River and Bay are major centers of petroleum industry activity. Most of the larger individual facilities presently have oil spill cleanup equipment and trained personnel on hand or on call. Cleanup cooperatives are found in both these areas. Several small cooperatives exist in the New York Harbor area. In the Delaware River and Bay area, a larger cooperative, the Oil Control Coordinating Committee, has been operating. Baltimore, Maryland, and the Hampton Roads area of Virginia also have petroleum handling facilities. Cooperatives are in operation

in these areas and, according to the Survey of Cooperatives Activity-Oil Spill Control (Marine Management Services), they had full operational capability as of September 1973. In addition, there are numerous individual contractors within the region. However, the above organizations are equipped primarily to handle inland and nearshore spills which might be associated with the existing refinery, port and terminal facilities within the region. Table IV-2 contains a partial listing of cleanup and containment equipment available through these contractors in combination with the Atlantic Strike Force.

In other OCS areas, companies involved in oil and gas operations have formed cooperatives in order to provide and maintain oil spill containment and clean-up facilities and operations. A group of 16 have formed such a cooperative on the Atlantic Coast. O.J. Shirley (in Public Hearings for the DES for Proposed Sale No. 40), indicated that the cooperative, Clean Atlantic, is planning to purchase fast response open sea and bay skimmer systems, an open sea containment boom, and other ocean and beach protection and clean-up equipment. It is planned to maintain a 24-hour readiness, and be able to respond within 12 hours to a spill as far as 125 miles from its shore base, under normal conditions. Equipment sufficient to handle one spill, with back-up capacity to commence cleanup of a second concurrent spill is envisioned.

Table IV-2.

PARTIAL LISTING
AVAILABLE EQUIPMENT IN MID-ATLANTIC AREA*

| ITEM | AVAILABLE |
|---|---|
| **CONTAINMENT BOOMS** | |
| SMALL (18" & UNDER) | 62,600 FT. |
| LARGE (19" - 36") | 28,000 FT. |
| EXTRA LARGE (OVER 36") | 4,200 FT. |
| **SKIMMING APPARATUS** | |
| SELF-PROPELLED | 1 |
| SELF-POWERED & OTHER | 141 |
| **OTHER EQUIPMENT** | |
| VACUUM BARGES | 4 |
| VACUUM TRUCKS | 28+ |
| PUMPS | 161+ |
| BOATS (OVER 15 FT.) | 93 |
| SORBENTS (PILLOWS & BAGS) | 35,000 |
| (BOOM) | 10,000 FT. |
| STORAGE | 32+ MILLION GALLONS |
| OCEAN GOING BARGES | 50 |
| AUTOMATIC PROPANE GUNS (BIRD SCARERS) | 12 |
| BIRD REHABILITATION UNITS | 2 |
| EARTH MOVING EQUIPMENT | READILY AVAILABLE |

*FROM U.S. COAST GUARD, OIL SPILL CLEANUP COOPERATIVES & CONTRACTORS, & OTHERS.

Source: Clean Atlantic Associates

4. OCS Operating Orders

Proposed OCS Operating Order 7 for the Mid-Atlantic (Appendix 11) requires that, prior to the initiation of operations, the lessee must prepare and have approved by the Area Supervisor, Geological Survey, an Oil Spill Contingency Plan. In order to implement the plan, the lessee must maintain or have available to him, the pollution control equipment and materials necessary to effectuate containment and cleanup. The equipment must be the most effective available, given the current state of oil pollution containment and cleanup technology. A memorandum of understanding between the Departments of the Interior and Transportation outlines the respective responsibilities of the Geological Survey (GS) and the Coast Guard (CG), regarding the supervision of abatement, containment, and cleanup efforts required by the proposed Orders. Essentially, the GS is responsible for the coordination and direction of measures to abate the source of pollution, whereas the CG is responsible for containment and removal operations, as further detailed previously.

Lessees in the Gulf of Mexico for example, in some instances, formed cooperatives to provide the containment and cleanup equipment and material required by the Orders. Clean Gulf Associates is an example of such a cooperative effort. A similar cooperative, Clean Atlantic Associates, has been formed on the Atlantic Coast, although it is presently only at the stage of contracting for service and planning for equipment purchases.

## 5. Status of Oil Spill Containment and Cleanup Technology

When oil is spilled on water, the first priority is to contain it or, in a river, direct it to a collection point and remove it by absorption, adsorption, or skimming. Presently available equipment is adequate for calm or enclosed waters but fails in rough sea conditions in excess of one knot currents and several foot waves (Boesch, 1974).

Booms are used for containment and various types are available. They normally fail when the accumulated oil behind the barrier is carried underneath it by the current. Most often booms available break apart in high sea states and are not easily deployable in rough weather. The Coast Guard has developed a High Seas Containment Barrier that is capable of withstanding 20 ft waves and 7 knot currents (Boesch, 1974), and of operating well in 4-6 ft waves, 2 knot currents, and 20 knot winds (Atlantic Strike Team, 1974). It can be transported by plane or truck and deployed fairly rapidly. Exxon has developed a boom that has been shown capable of surviving in 20 ft waves, 2 knot currents, and 60 knot winds and of operating well in 6-8 ft waves, 1 knot currents, and 20 knots winds (CEQ, 1974b). However, the boom is cumbersome and not easily deployed. To date, the best boom performance that has been reported (Exxon) is containment in 6 to 8 foot seas with 20-mile winds and 1.25 knot currents. Improvements are being made but the effectiveness of booms is reaching its upper limit (CEQ, 1974b).

After containment, the oil must be collected. Straw is rapidly being replaced by mechanical skimmers and synthetic sorbents in this task. Skimmers operate on various principles and some types are now available that work well in 6-8 ft waves, 3 knot currents, and 40 knot winds (Atlantic Strike Team, 1974), however, these latter types operate at low recovery rates (1 to 5 barrels per minute). The Coast Guard is developing a combination boom and skimmer system, but this will not be available for some time. Recovered oil can then be transferred to a refinery for recycling.

When the oil slick becomes too thin to be collected by these devices absorbents and adsorbents like straw or the newer synthetic materials can be used. The synthetic sorbents include polyurethane foam, alkyl-styrene beads and other coleophilic products. These absorb or adsorb 5-30 times their weight in oil, and some can be wrung out and reused. The problem with sorbents is that they themselves must be collected either mechanically or manually to prevent them from contaminating the environment.

Various chemicals may also be used to assist in collecting, dispersing, or removing the oil. Surface tension modifers and collecting agents prevent or restrict the spreading of oil on the water's surface and "thicken" the oil slick for easier collection by the skimmers and mops. Their use is authorized when it will result in the least overall damage to the environment or interference with designated water uses. Dispersants can be used to form oil-in-water emulsions that facilitate the dispersal of oil into the

water column. As previously indicated, the use of these chemicals is limited, however, because of their potentially toxic effects on marine organisms. Biological agents that encourage biodegradation of the oil may also be used if previously approved. Burning agents that improve the combustibility of oil may be applied if they have been approved by EPA, and if their use will reduce imminent danger to life, limb, or property and will result in the least environmental harm when compared to other methods. The use of sinking agents is not allowed on the navigable waters of the United States.

All of the above methods are effective in calm harbor and nearshore waters but face severe limitations on the open seas, not the least of which are the 12 or more hours required to respond to a spill several miles offshore as might be the case in this proposed sale area. Oil spill containment on the open sea, then, is severely limited. However, because the effectiveness or efficiency of recovery for any particular spill depends upon a combination of wind and wave conditions, and other physical parameters, no estimate can be made of what percentage of a spill could be recovered or what amount could be recovered.

Toxicity studies involving the various chemicals available for use for collecting, dispersing, and removing oil are, by requirement, available through EPA.

## D. Mitigations Included for Specific Aspects of the Proposed Action

### 1. Offshore Structures and Pipelines

In the event this proposed Mid-Atlantic sale is held, development of the tracts in this proposal which lie partially within shipping lanes, will be subject to Federal regulation of the Army Corps of Engineers and Coast Guard so far as placement of structures is concerned.[1] This would help mitigate any potential impacts due to the proximity of structures to relatively high frequency sea traffic.

The USGS Oil and Gas Supervisor must consider the views of commercial fishing organizations and fishermen with regard to placement of platforms. The Supervisor must also coordinate with the Department of Commerce, Fish and Wildlife Service and the Bureau of Land Management, in the decision-making process of approving or disapproving platform installation. Recent changes[2] in 30CFR 250.34 require that the development plan, minus proprietary data, be submitted in advance to Governors of adjacent affected states. Under that arrangement, states have an opportunity to comment on platform placement.

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[1] Appendix 7.

[2] See Section IV.A.1.b. of this EIS.

Platforms are designed for removal after their operational life. Following the depletion of all producing zones developed from a platform, wells will be plugged and abandoned. Well conductors and platform piling will be cut below the mudline and removed, drilling and production equipment dismantled and removed, the deck units removed, and the site restored in accordance with permit requirements.

Proposed OCS Order 7 and EPA regulations prohibit the disposal of solid waste offshore from operations which might result from this proposed sale.

As mentioned previously, should producible quantities of oil and/or gas be discovered the BLM will conduct pipeline corridor management studies in an effort to determine the most technically and environmentally practical route(s).

At present, the cooperative effort between the Department of the Interior, Corps of Engineers, National Marine Fisheries Service and State conservation agencies is responsible for minimizing the impact of pipeline (and other) construction in navigable waters of the United States in the following manner. The Corps of Engineers, through authority of the Rivers and Harbors Act of 1899 (33 U.S.C. 403), asserts authority over, and requires a permit for, construction in all navigable waters subject to the Submerged Lands Act

(43 U.S.C. Sec. 1301) and includes all lands permanently or periodically covered by tidal waters up to the line of mean high tide.

The Environmental Protection Agency reviews and comments on dredging projects in navigable waters in accordance with a memorandum of understanding with the Corps of Engineers dated July 13, 1967.

The National Oceanic and Atmospheric Administration (through its National Marine Fisheries Service) has been vested with responsibility for participation in matters relating to marine and estuarine areas. The U.S. Fish and Wildlife Service, with assistance from appropriate State and Federal agencies, including the National Marine Fisheries Service, now reviews all applications to the Corps of Engineers for permits to construct pipelines in navigable waters and assess their potential impact on fish and wildlife resources and the environment. Especially sensitive areas such as any area of special biological significance, bay, or estuary occupied by rare or endangered species would be examined very critically. When appropriate, the agency recommends to the Corps specific modification of project plans which are needed to reduce impact on these resources.

In addition to the above efforts to mitigate potential impacts associated with pipelines, the Bureau of Land Management and the Geological Survey, by virtue of a memorandum of understanding, have taken steps to clearly define their respective administrative and operational roles. The purposes and objectives are to: 1) mimimize

or eliminate environmental damage; 2) better serve industry and public interests; and 3) streamline the regulations and procedures for most efficient and uniform administration, operation, and industry compliance. This clarifies the administrative and operational roles of both BLM and USGS in regards to OCS pipeline management. The text of this memorandum can be found in Appendix 2.

Each application for a pipeline right-of-way will be reviewed on a case basis by the BLM New York OCS Office. A special stipulation set forth in Section IV.E. and proposed OCS Order 9 (still being prepared for the Mid-Atlantic OCS) will set forth requirements for pipeline burial, including pipelines for delivery to shore and field gathering and flow lines.

The Materials Transportation Bureau of the Department of Transportation also applies its standards for offshore pipelines to the Mid-Atlantic. Certificates of Public Convenience and Necessity for gas pipeline crossings on land are issued by Federal Power Commission.

2. Measures Involving Military Uses of the OCS and NASA Rocket Trajectories

The Departments of Interior and Defense have concluded that none of the tracts to be offered in this proposed Mid-Atlantic sale will conflict with military operations on the OCS. Military operations offshore and nearshore (gunnery, training missions) will be rescheduled so as not to interfere with oil and gas operations

(boats and helicopters, offshore structures). Flights to offshore structures (rigs, platforms), as stated before, will be cleared with the Commander, Eastern Sea Frontier (U.S. Navy), for additional measures of safety. A Special Stipulation (Section E. following) provides for surveying the ocean floor in tracts where military munitions are suspected to have been jettisoned.

3. Onshore Facilities

There are four major types of onshore facilities that will be directly generated by this proposed Mid-Atlantic OCS oil and gas activity:

1. Terminal and storage facilities;
2. Onshore operations bases;
3. Gas processing plants;
4. Pipelines (onshore portions).

This section summarizes existing regulatory schemes at the federal, state,[1] and local levels that can be implemented to mitigate the potential adverse effects of these facilities. This discussion is on a facility basis and addresses programs and approaches of specific as well as general applicability.

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[1]The recent changes in 30 CFR 250.34 provide for a new method in which affected states receive advance information on proposed facility siting and have an opportunity to comment on development plans before they are approved by the USGS (see Section IV.A.1.b.).

a. Terminal and Storage Facilities

The Federal Water Pollution Control Act (FWPCA), as amended in 1972, provides for a National Oil and Hazardous Substances Pollution Contingency Plan for which the Environmental Protection Agency (EPA) and the Departments of Interior, Transportation and Defense all share responsibility. EPA, however, has the authority over onshore nontransportation facilities, such as terminal and storage areas. The operators of such facilities are required to prepare and implement Spill Prevention Control and Countermeasure Plans. The 1970 Amendments to the Clean Air Act established minimum standards for pollutants generated by evaporation from oil storage facilities. The facility operator must make any design and operational adjustments necessary to meet the standards before a permit to operate the facility will be granted. All five Mid-Atlantic States have approved state air plans pursuant to the Act. Consequently, the permitting programs thereunder are administered by the respective states with EPA having monitoring and oversight responsibility. These controls affect only the manner of operation of a facility and do not have locational effects except as different locations may more readily accommodate required design changes.

The primary means of affecting the siting of an oil terminal and storage area is the zoning power of the localities. All of the

Mid-Atlantic coastal counties have active zoning plans except Accomack, Virginia. State authorities could be used to prohibit the placing of these facilities in certain types of areas. All five states, for instance, have legislation[1] setting up programs that regulate the use of wetlands by way of a permitting system. New York, Maryland, and Virginia have legislation that requires environmental impact statements for specified types of state actions. Generally, if it appears that an application for a state permit might be granted, it would then be considered as a potential state action, thereby invoking the state's environmental impact statement requirements. A permit can be issued contingent on specified mitigatory actions. While the state environmental impact statements do not provide a direct regulatory/mitigatory function, they do provide a public forum conducive to the consideration and incorporation of mitigatory actions and alternative approaches. Approval at the state level, through permitting and/or environmental impact statement procedures, does not negate the necessity of conformance with local zoning plans.

The proposed location of oil terminal and storage facilities in

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[1] Maryland (1970), New Jersey (1970), Virginia (1972), New York (1973), and Delaware (1973).

other than wetland areas would still be subject to state regulatory functioning. The permits required by the Clean Air Act, as amended, would be necessary regardless of a facility's potential location. Presumably, in those states that possess them, the permit application would invoke the environmental impact statement processes. Additionally, New Jersey[1] and Maryland[2] have legislation that requires a permit for the placement of oil terminal and storage facilities in specified coastal areas. In both instances environmental impact statements would be required and the proposed facilities would have to be in conformance with local zoning plans.

b. Onshore Operations Bases

Any Federal involvement in regulating the siting of operation bases would be limited to situations where dredging and filling of navigable waters were involved. In those situations, a permit would be required from the Corps of Engineers after review and comment by appropriate agencies. Stipulations can be placed on the construction of such facilities as prerequisities to the issuance of a permit.

State involvement in the siting of an operations base would occur (1) where the regulatory responsibilities under the respective wetlands

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[1] Coastal Area Facility Review Act (1973).

[2] Coastal Facilities Review Act (1975).

acts are invoked and (2) in their formal comments to the USGS on OCS operator supplied development (minus proprietary information) plans. The permitting processes under wetlands acts, as discussed above, would consequently trigger the state environmental impact statement requirements. Additionally, Maryland has specific legislation[1] that requires the permitting of an operations base even in the absence of applicability of wetlands legislation. The act is invoked where the proposed onshore operations base occupies at least 25 acres. An environmental impact statement is required as a part of the permitting process. New Jersey also has specific legislation[2] that would, under existing regulations, be invoked regardless of the size of the "marine terminal." As previously discussed, a permit and concomitant environmental impact statement would be required and possible mitigatory actions could be considered as a part of the process. In all of these instances the proposed facility would have to be in conformance with appropriate local zoning plans.

c. Gas Processing Plants

The air emissions and water discharges emanating from these facilities would require permits under both the 1972 Amendments to the FWCPA and the 1970 Amendments to the Clean Air

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[1] Coastal Facilities Review Act (1975).

[2] Coastal Area Facilities Review Act (1973).

Act. In the latter case, all five Mid-Atlantic States have plans approved by EPA and consequently, the permitting systems are operated by the respective States with monitoring and oversight by EPA. New York, Delaware, Maryland, and Virginia have approved waste water plans and consequently, they operate their own permitting systems with monitoring and oversight by EPA. In New Jersey, the water permitting program is the responsibility of EPA pending takeover by the State. In Maryland, and Virginia, the application for one of the above permits would invoke the States' environmental impact statement requirements.

If a proposed gas processing plant involved the use of wetlands, the permitting processes under the wetlands acts would be invoked. In such instances, environmental impact analyses would be required as prerequisite to the issuance of a wetlands use permit. Specific legislation in New Jersey[1] would require a permit, and an environmental impact statement prerequisite to its issuance, for the location of a gas processing plant in the legislatively defined coastal zone. Legislation in Delaware[2] would ban such a facility in a legislatively defined coastal zone. Generally, even after permitting and environmental impact statement processes have been satisfied, the proposed facilities must be in conformance with appropriate local zoning plans.

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[1] Coastal Area Facilities Review Act (1973).

[2] Coastal Zone Act (1971).

d. Pipelines

Federal responsibility in regard to onshore pipelines, both oil and gas, is divided among several agencies. The Materials Transportation Bureau in the Department of Transportation (DOT) has the primary responsibility for assuring pipeline safety. Their concerns address safety through pipeline design as well as construction and operational practices. Their responsibility is basically one of setting standards. Similar to offshore pipelines, the MTB is involved in pipeline safety and inspection to cause, by those responsible for the pipelines, the prompt reporting of any potential leaks or safety problems, and report annually to the President, the Congress, the Secretary of the Interior, and the Interstate Commerce Commission of any potential leaks or actual explosions and spillages in these pipelines.

The Federal Power Commission can authorize the bringing ashore of natural gas pipelines by issuing a Certificate of Public Convenience and Necessity. If the FPC feels it necessary, the agency prepares an environmental impact statement to evaluate aquatic and onshore impact of potential production from the pipeline.

The Corps of Engineers also becomes involved where a proposed pipeline crosses navigable waters. The wetlands legislation in the respective states would require permitting and environmental impact statements for pipelines proposed for construction through wetlands. Several states possess regulations, as part of their pollution prevention programs, that would require permits and appropriate environmental

analyses if proposed pipelines were to cross any watercourse. New Jersey[1] and Maryland[2] have legislation that would require permitting and appropriate environmental analyses for proposed pipelines in legislatively designated portions of the coastal zone. Although local plans may be formulated that identify desirable utility corridors, rarely do zoning plans restrict pipelines to predetermined locations. Local ordinances may, however, prescribe procedures for obtaining local review and approval of proposed pipelines. Direct federal responsibility for the siting of onshore facilities is limited except for federally administered lands. Some federal regulatory responsibilities, however, could indirectly influence the siting and subsequent operation of these facilities. Essentially, federal regulatory programs can be invoked, in some instances, to mitigate operational, but not locational, adverse effects. State and local planning and regulatory authorities provide the primary framework within which potential adverse effects on the onshore facilities can be addressed. The regulatory authority of the states has both operational and locational significance. It is primarily the local zoning power, however, that provides the basis for affirmative action to mitigate adverse effects stemming from locational factors.

It is the intent of the Bureau to require, , wherever possible, pipeline corridors in the area of this proposed sale to minimize disturbance of the environment and disruption of other uses of the OCS. Additionally, such corridors could help mitigate some of the potential impacts of onshore facilities which could result in the absence of such comprehensive

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[1]Coastal Area Facilities Review Act (1973)

[2]Coastal Facilities Review Act (1975)

planning efforts. A proposed lease stipulation that will be included in each Mid-Atlantic oil and gas lease, will enable the Bureau to require that pipelines used to transport oil to shore be placed in designated corridors. If commercial quantities of oil are discovered, pipeline corridor management studies will be initiated to identify the least environmentally hazardous areas in which to require the placement of lines. Although these studies are primarily concerned with the OCS, they will also include areas suitable for the location of onshore processing and support facilities, and will be coordinated with other Federal, State and local authorities.

If commercial finds of hydrocarbons are made, then pipeline corridor management studies will be conducted in two phases. The first phase will identify macro-corridors (including potential landfall areas) using existing environmental and socio-economic data. Representatives of affected states as well as the petroleum industry, will be encouraged to participate in this planning effort. Once tentative corridors have been identified the second phase of the study effort will be initiated. It will consist of a BLM-funded contract study to obtain quantitative biological, chemical, geological and physical oceanographic baseline data for the tentatively identified corridors. The collected data, once analyzed, will be utilized to select the final corridors and landfall locations with the least net environmental and socio-economic adverse impacts.

E. Special Stipulations

Leases issued for oil and gas exploration and development on the Outer Continental Shelf are subject to all provisions of the Outer Continental Shelf Lands Act of August 5, 1953, and to all regulations promulgated pursuant to the Act by the Secretary of the Interior. Regulations in 30 CFR 250.12 authorize the Area Oil and Gas Supervisor, Conservation Division of Geological Survey, to issue OCS Orders and other orders and rules necessary to effectively supervise operations and to prevent damage to, or waste of, any natural resource, or injury to life or property. An OCS Order is a formal numbered order that implements regulations and applies to operations within a region or a major portion thereof. Draft OCS Orders (revised draft, incorporating comments received pursuant to the Federal Register comment period) for the Mid-Atlantic are discussed in Section IV.A.

Stipulations consist essentially of regulations imposed upon a specific lease or group of leases. The stipulations are incorporated into the specific leases by reference and attachment. Thus, a given lease is subject to all provisions of the OCS Lands Act, to regulations promulgated pursuant to the Act, to OCS Orders issued for the geographic region in which the lease exists, and to any special stipulations particular to it.

The following is a discussion of the possible stipulations that may be applied to any lease resulting from this proposed sale, except for Stipulation #7, which is proposed to be applied only to leases issued for specific blocks on Protraction Diagram NJ 18-3.

1. Cultural Resources

If the Supervisor, when having reason to believe that a site, structure, or object of historical or archeological significance, hereinafter referred to as "cultural resource," may exist in the lease area, gives the lessee written notice that the lessor is invoking the provisions of this stipulation, the lessee shall immediately upon receipt of such notice comply with the following requirements:

Prior to any drilling activity or the construction or placement of any structure for exploration or development on the lease, including but not limited to, well drilling and pipeline and platform placement, hereinafter referred to as "operation", the lessee shall conduct geophysical surveys to determine the potential existence of any cultural resource that may be affected by such operations. All data produced by such geophysical surveys shall be examined by a qualified marine archeologist or archeological surveyor to determine if anomalies are present which suggest the existence of a cultural resource that may be adversely affected by any lease operation. If such anomalies exist the lessee shall:

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[1]The wording of the stipulations included in this section was arrived at after joint discussions of the BLM, USGS and Fish and Wildlife Service under procedures of Secretarial Order 2974.

1) locate the site of such operation so as not to adversely affect the anomaly identified; or 2) establish, to the satisfaction of the Supervisor, on the basis of further archeological investigation conducted by a qualified marine archeological surveyor using such survey equipment and techniques as deemed necessary by the Supervisor, either that such operation will not adversely affect the anomaly identified or that the potential cultural resource suggested by the occurrence of the anomaly does not exist.

Upon completion of any geophysical or other survey conducted for archeological purposes, the lessee shall forward a report prepared by the archeological surveyor to the Supervisor for his review. Should the Supervisor determine that the existence of a cultural resource which may be adversely affected by such operation is sufficiently established to warrant protection, the lessee shall take no action that may result in an adverse effect on such cultural resource until the Supervisor has given directions as to its disposition.

The lessee agrees that if any site, structure, or object of historical or archeological significance should be discovered during the conduct of any operations on the leased area, he shall report immediately such findings to the Supervisor, and make every reasonable effort to preserve and protect the cultural resource from damage until the Supervisor has given directions as to its disposition.

Archeology reports covering leases issued as a result of this proposed sale will be submitted to the Area Oil and Gas Supervisor of the Geological Survey and to the Manager of BLM. The Manager will review these reports and provide the Supervisor with recommendations for protection of any known or potential cultural resources identified therein. The Supervisor will consider these recommendations and any other relevant information at his disposal prior to issuing a permit for operations at a specific location within a lease.

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[1] Cultural resources will be handled according to procedures being developed by BLM to comply with regulations outlined in 36 CFR Part 800.

2. Biologically Important Areas

Studies by the Bureau of Land Management and other studies may not yet have located sites which could be biologically sensitive to drilling or contain undeveloped commercial fish or shellfish resources. This stipulation is designed to protect these sites.

Should any area of special biological significance be discovered during the exploration, development, and/or production stage(s) or as a result of Bureau of Land Management Baseline Studies, the lease block(s) or portion(s) thereof containing said area or resource shall not be explored and/or developed until the lessee has demonstrated to the satisfaction of the Supervisor that adequate technology and sufficient environmental safeguards exist and will be used to prevent to the maximum extent possible, using the best available technology and all reasonable care, detrimental impact upon said areas.

If the Supervisor when having reason to believe that such a site or resource may exist in the lease area, gives the lessee written notice that the lessor is invoking the provisions of this stipulation, the lessee shall immediately upon receipt of such notice comply with the following requirements: prior to any drilling activity or the construction or placement of any structure for exploration or development of lease areas including, but not limited to, well drilling and pipeline and platform placement, hereinafter in this stipulation referred to as "operation," the lessee shall conduct site specific surveys, as approved by the Supervisor, to determine the potential existence of any unique biological resource that may be adversely affected by any lease operation. If such surveys show anomalies that suggest the potential existence of a unique biological resource that may be adversely affected by any lease operation, the lessee shall:

1) Relocate the site of such operation so as not to adversely affect the anomaly identified; or 2) establish, to the satisfaction of the Supervisor, on the basis of the site specific survey, either that such operation will not adversely affect the anomaly identified or that the potential biological resource suggested by the occurrence of the anomaly does not exist.

All data obtained in the course of any biological surveys conducted pursuant to the provisions hereof shall be submitted to the Supervisor with any application by the lessee for drilling or other activity with a copy to the Manager, New York OCS Office. Should the Supervisor determine contrary to the contentions of the lessee, that the existence of a biological resource which may be adversely affected by such operation is sufficiently established to warrant protection, the lessee shall take no action that may result in any adverse effect on such resource until the Supervisor has given the lessee directions with respect to the resource.

The lessee agrees that, if any site, structure, or object of biological significance should be discovered during the conduct of any operations on the leased area, he shall report immediately such findings to the Supervisor, and make every reasonable effort to preserve and protect the resource from damage until the Supervisor has given the lessee directions with respect to the resource.

3. Placement of Structures

To reduce potential disturbance to other ongoing activities in the Mid-Atlantic OCS and the environment as a result of this sale, we propose this stipulation:

Structures for drilling or production, including pipelines and subsea systems, shall be kept to the minimum necessary for proper exploration, development, and production and, to the greatest extent consistent therewith, shall be placed so as not to interfere with other significant uses of the Outer Continental Shelf including commercial fishing. To this end, no structure for drilling or production, including pipelines and subsea systems, may be placed on the Outer Continental Shelf until the Supervisor has determined that the structure is necessary for the proper exploration, development and production of the lease area and that no reasonable alternative placement would cause less

interference with other significant uses of the Outer Continental Shelf, including commercial fishing. The lessee's exploratory and development plans, filed under 30 CFR 250.34, shall identify the anticipated placement and grouping of necessary structures including pipelines and subsea production systems, showing how such placement and grouping will have the minimum practicable effect on other significant uses of the Outer Continental Shelf, including commercial fishing.

It is within the authority of the Geological Survey and the Secretary to require unitization of a field, but to require this action before knowing the actual production characteristics of a field (by use of a special stipulation) would be unwise. The designation of specific pipeline corridors by BLM will serve to reduce the number of pipelines used. This stipulation is designed to keep the number of offshore facilities to a minimum.

4. Shipping of Oil

Because of the heavy tanker and barge traffic presently existing in the Mid-Atlantic, and resulting incidents of vessel accidents and pollution occurrences, we propose that to the most practical extent possible, oil produced in the Mid-Atlantic OCS be prohibited from transport via tankers and barges. The following stipulation would minimize such transport:

> If feasible pipeline rights-of-way can be determined and obtained and, if laying such pipelines is technically and economically feasible, no crude oil production will be transported by surface vessel from offshore production sites to adjacent onshore facilities except in case of emergency. Determinations as to emergency conditions and the technical and economic feasibility of pipeline laying will be made by the Supervisor. For continuous production, transportation of crude oil by barge from offshore production sites to adjacent onshore facilities will not be permitted.

The phrase indicating exceptions relating to emergency conditions or special circumstances is included to encompass problems, such as relief of pressure or maintenance, where some oil is produced but cannot be disposed of in any other environmentally safe manner. Test production will be of short duration and will not require transport to shore.

Due to the present channel depths which tankers (if used) would operate in and expected production levels, we anticipate that if tankers have to be used, the sizes employed would be well under 70,000 dead weight tons. Economic constraints dictate against using larger vessels and transferring the oil to barges in estuaries for final transshipment to refineries.

5. Pipeline Corridors

It is the intent of the Bureau to require, wherever possible, pipeline corridors in the area of this proposed sale to minimize disturbance of the environment and disruption of other uses of the OCS. To this effect, the following provision shall apply to all leases in the event this proposed sale should proceed:

> The lessor specifically reserves the right to require that any pipeline to be used for transporting production from this lease to shore be placed in certain designated areas or corridors.

6. Pipeline Burial

To reduce the potential of damage to pipelines caused by trawling gear and anchors and to reduce the threat of oil spills

resulting from such damage, the following stipulation will also apply to all leases in this proposed sale. Flowlines deliver oil and/or gas from offshore platforms to common carrier pipelines whereas gathering lines may take oil and/or gas from platform to platform or subsea system to platforms.

> Wherever technically and economically feasible, all pipelines, including both flow lines and gathering lines for oil and gas, shall be buried to a depth suitable for adequate protection from water currents, storm scouring, fisheries trawling gear, and other use and environmental factors as determined by the Department of the Interior permitting agency on a case-by-case basis.
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> Surveillance of all buried pipelines shall be conducted at regular intervals to ensure that they remain buried. Surveillance methods utilized shall be those specified in present and future OCS Orders and regulations or as approved by the Department of the Interior permitting agency.

7. Undetonated Explosives

This stipulation has been developed to require lessees of specific tracts to perform surveys in order to locate explosives which are known to be in the area. The requirements for the surveys will be developed by the oil and gas supervisor and probably issued as a Notice to Lessees and Operators.

Leases issued as a result of this proposed lease sale embracing blocks 769, 770, 771, 812, 813, 857, and 858 of protraction diagram NJ 18-3, will contain the following stipulation related to the presence of undetonated explosive devices:

> Prior to any drilling activity or the construction or placement of any structure for exploration or development on the lease, including but not limited to, well drilling and pipeline and platform placement, hereinafter in this stipulation referred to as "operations," the lessee shall conduct geophysical or other surveys as specified by the Supervisor to determine the existence of any unexploded ordnance, munitions, mine or bomb. If any object is found which may be such a device, the lessee shall:
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> > 1) Locate the site of such operation so as not to adversely affect the object identifed; or 2) establish to the satisfaction of the Supervisor, on the basis of further investigations using such survey equipment and techniques as deemed necessary by the Supervisor, either that such operation will not affect the object identified, that the operation will not be affected by the object or that the object is not an explosive device.
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> Upon completion of any geophysical or other survey conducted for the purpose of locating undetonated explosive devices, the lessee shall forward a report to the Supervisor for his review. Should the Supervisor determine that the existence of such devices may adversely affect the operation, the lessee shall take no action until the Supervisor has given directions as to the conduct of those operations.
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> The lessee agrees that if any undetonated explosive device should be discovered during the conduct of any such operations on the leased area, he shall report immediately such findings to the Supervisor, and make every reasonable effort to avoid the detonation of said device until the Supervisor has given directions as to its disposition.

F. Other Mitigating Measures

1. Notices to Lessees and Operators

Notices to Lessees and Operators are used when expeditious clarifications, corrections, or additions to the OCS Orders and regulations are necessary. By issuing Notices to Lessees and Operators, the extensive amount of time necessary to amend and republish orders and regulations is avoided. None have been prepared to-date for the Mid-Atlantic OCS.

However, an example of such a "Notice" which has been issued in other OCS areas and that may be issued in this Mid-Atlantic proposal is a "Notice of Support Activity for the Exploration Program." This "Notice" is intended to assist coastal States and communities in planning for the impact of activities during exploration activities. It may require that the lessee must submit, for review and comment to the Governor of the directly affected States, a reporting of activities that will be needed for his exploration program. The lessee will not be required to include privileged information in the Notice. He will have the option whether to submit a separate Notice for each Exploration Plan submitted under 30 CFR 250.34 on a lease or to submit a Notice in connection with two or more Plans on one or more leases. The Notice shall not be subject to approval or disapproval by the USGS Supervisor, but the Supervisor, in acting on an Exploration Plan, will take into account the comments of the States.

A copy of the Notice shall be submitted to the Supervisor simultaneously with or prior to the Exploration Plan with a certification that it has already been submitted to the Governors of the States that will be

directly affected by activities under the Plan. If the lessee submits a Notice in connection with two or more Exploration Plans, he will not be required to submit additional copies of the Notice, but may instead refer to that previous submission. Before the USGS Supervisor approves or disapproves the Exploration Plan, he will allow at least 30 days from the date of receipt of the certification for the Governor to submit comments on the Notice to him as well as to the lessee. Subsequent to the submission of the certification, significant changes in estimated support activities will be forwarded by the lessee, as an amendment to the Notice, to the Governors that will be directly affected by the program, and the USGS Supervisor.

The Notice shall include with respect to the lessee and his contractors:

(1) A description of the facilities, including site and size, that may be constructed, leased, rented or otherwise procured in affected areas;

(2) The location and amount of acreage required within the State for facilities, including the need for storage of various supplies;

(3) An estimate of the frequency of boat and aircraft departures and arrivals, on a monthly basis, and the onshore location of terminals;

(4) The approximate number of persons who will be engaged in onshore support activities and transportation, the approximate number of local personnel who will be employed for or in support of the exploration program, and the approximate total number of persons who will be employed for the exploration program;

(5) The approximate addition to the population of the local jurisdiction because of the exploration program and the approximate number of persons needing housing and other facilities;

(6) An estimate of any significant quantity of major supplies and equipment to be procured within the State; and

(7) The onshore addresses of the lessee's operation offices and of the contractor's offices involved with the exploratory operation.

2. Waivers of OCS Orders

A departure (waiver) from OCS Orders or other rules of the USGS Supervisor may be granted under 30 CFR 250.12(b), when such a departure is determined to be necssary for one of the following reasons:

(a) The proper control of a well;

(b) Conservation of natural resources;

(c) Protection of aquatic life;

(d) Protection of human health and safety;

(e) Protection of property; or

(f) Protection of the environment.

3. Unitization of Producing Fields

The following regulations enable the Department of the Interior to require that a producing oil and/or gas field be unitized and the manner in which it is to be carried out, although no unitization requirement has been decided on, as yet, for this proposed sale:

30 CFR 250.50 grants the Director of the USGS authority to demand pooling or unitization which the Secretary is authorized to require under the OCS Lands Act in the interest of conservation.

30 CFR 250.51 refers to the unit plan regulations contained in 30 CFR 226 with regard to obtaining approval of units or cooperative agreements.

30 CFR 250.52 lists purposed for which the Area Oil and Gas Supervisor of the USGS may approve pooling or drilling agreements.

Unitization has taken place in the operating areas where a field overlies adjacent tracts (usually 2 to 4) and each tract is owned by different operators. The authority to unitize may be utilized for purposes of conservation, controlling withdrawls of oil and gas from the field, more efficient production, and reservoirs prssure maintenance during initial stages of operation.

4. Geophysical Information Concerning Geological Hazards

Knowledge of near-surface structural conditions is fundamental to a sound lease management program for the OCS. Geophysical data, which show the shallow structural and sedimentary environment, are used to predict, and thus minimize, any geological hazards to drilling operations and consequent possible dangers to the environment from pollution. Surface and shallow subsurface geologic hazards, when properly identified and correlated with surrounding strata, seldom crete insurmountable obstacles to a

minimal risk program of exploration and exploitation of economically attractive structures.

High resolution geophysical data covering all tracts to be offered for this proposed sale are presently being analyzed by geophysicists and geologists of the USGS Conservation Division and will also be analyzed by BLM geologists prior to the proposed sale. These data, in the area of coverage, provide definitive information on thickness of the unconsolidated sediment; structural configuration on shallow seismic horizons; sea floor anomalies; slumps; shallow subsurface faults; unstable bottoms; near-surface gas pockets; and buried subsurface channels. Preliminary analyses have already been conducted on high resolution geophysical records collected by the USGS Geologic Division in Woods Hole as part of the BLM environmental studies program; the records are also being examined by personnel of the USGS Conservation Division, Eastern Region Office (Washington, D.C.).

Interpretations of high resolution subbottom profile data made by potential lessees that will disclose bottom subsurface conditions posing special environmental hazards for drilling or producing operations in the Mid-Atlantic offshore area, will be made available

to the Bureau of Land Management prior to the decision to issue a lease, and to the Geological Survey prior to the approval of legislative drilling operations.[1]

G. Uncommitted Mitigating Measures

In addition to the committed measures previously discussed, there are other actions which, if implemented, could further mitigate adverse impacts. However, the following actions are currently uncommitted and not part of this proposal as they are beyond the existing authority of the Bureau of Land Management.

(1) Requiring the use of bird repelling techniques during appropriate oil spill situations;

(2) Implementing energy facility siting legislation at the state level.

One measure that could further reduce the risk to birds from oil pollution would be the use of scare devices when large spills occur. Techniques to repel marine birds for sustained periods of time from the area of an oil spill have proven practical and effective for

[1]The District Supervisor, Geological Survey, will prohibit the placement of platforms on areas of instability, should the need arise, through his authority, to issue or not issue permits for platform placement.

several species of water-oriented birds (Crummet, no date). These devices are available in the Mid-Atlantic region in case of spills, but there are no requirements for their use. It should be pointed out that the devices are not effective for all species and more research is needed to produce greater success.

At present, none of the Mid-Atlantic states has the legislative authority to affirmatively identify and study specific sites that could appropriately accommodate key energy-related facilities. The Virginia Land Use Council, however, has submitted a report to the Governor concerning the siting of key facilities including energy-related facilities.

Existing state actions focus on regulating the placement of such facilities after a specific site has been identified by the proposer. In essence, the States' regulatory functions are reactionary in that they are not activated until a specific proposal has been made. Affirmative action by the state in identifying and, as appropriate, acquiring specific locations for such facilities would minimize adverse impacts of a facility, provide direction to desired economic growth, and significantly decrease the usual time lag between project proposal and actual implementation.

## V. ADVERSE ENVIRONMENTAL IMPACTS WHICH CANNOT BE AVOIDED SHOULD THE PROPOSAL BE IMPLEMENTED

### A. Marine Organisms

The proposed lease sale in the Mid-Atlantic would result in certain unavoidable impacts to marine organisms. The discharge of drilling mud and cuttings and the excavation of pipeline trenches by jetting and dredging result in temporary increases in turbidity or suspension of toxic materials in the water column.

During the exploratory phase it is estimated that from 41,490 to 397,613 tons of commercial water-based drilling mud will be released into the marine environment. It is further estimated that from 37,341 to 357,852 tons of that total will be directly discharged into the sea with the remainder to be found in the bore hole or drill cuttings. (Ocean disposal of oil-based drilling muds will not be allowed by the USGS.) During development drilling only about 10 percent of the drilling muds are lost to the marine environment via drill cuttings and retention in the bore hole (Section III.A.1.).

It is also estimated that from 64,770 to 1,590,673 tons of cutting would be disposed of and from 800,000 to 8,960,000 cubic yards of sediment would be disturbed in the pipeline burial process (discussion appears in Section III.A.1.). The resulting turbidities can lead to a decrease in the output of the photosynthetic mechanism of the phytoplankton or light-dependent organisms and result in a decrease in primary productivity. Increased turbidity may also damage plankton populations by physical abrasion, decreased egg buoyancy and reducing respiratory and feeding efficiencies of various organisms.

In offshore areas, drill cuttings discharged during exploration and development can impact benthic forms. Their filter feeding and respiratory mechanisms can be interrupted and they can be smothered if the cuttings are not dispersed.

Resuspensions of toxic pollutants maintained in sediments in heavily polluted areas such as outfalls and dumpsites is a possibility during drilling and pipeline burial operations. Pipelines, however, can be designed to avoid these areas and will be evaluated in a separate pipeline corridor study. The amount of resuspended toxic pollutants which would be accumulated in the food chain or be directly lethal to organisms as a result of this operation is unknown at this time. Exposure of biota to harmful or toxic materials released into the marine or coastal environment, such as from unavoidable spills of crude oil, could bring about an unquantifiable adverse impact. The effects of crude oil, depending on its composition, consist of lethal toxicity, various sublethal effects, coating, behavioral changes and habitat disturbances. The more subtle effects associated with chronic contamination may be serious also, but are not well understood at this time. During the producing life of the proposed leasing area, it is estimated that from 6,229 to 49,442 barrels of oil could be spilled (Section III.A.2.) as a result of blowouts, explosions, and fires and from pipelines.

B. Vegetation

Some impacts resulting from pipeline burials and related construction activities on the vegetation will be unavoidable. Pipelines

and construction activities can be located to avoid fragile areas and will be evaluated in a separate pipeline corridor study. Impacts will be localized and restricted to construction sites.

Vegetative communities have been shown to suffer adverse impacts from chronic exposure to oil which can result in denudation. The impact of a single oil spill depends, to a large extent, on various factors such as type of oil, time of year, and plant species involved. It is believed that plant communities could survive moderate oilings.

C. Wildlife

Pipeline burials and related construction activities will have some unavoidable impact. This type of impact, however, can be minimized by avoiding particularly sensitive habitat areas. Unavoidable impacts of this activity will be evaluated in more detail in a separate pipeline corridor study.

Oil spills also pose an unavoidable threat to wildlife. Impacts upon wildlife resulting from spills are unquantifiable. Nearshore spills resulting from pipelines or tanker accidents (if tankers have to be used) pose the highest threat. Areas surrounding anticipated pipeline routes (coastal New Jersey and to a lesser extent Delaware and Maryland) and tanker routes (New York Harbor and Delaware Bay) would be the most vulnerable to nearshore spills. Previous spills indicate that sea birds, by far, receive the greatest impacts and their fatalities can be large. Onshore species can also suffer from spills due to loss of feeding and nesting habitats.

Time of day, time of year, sea conditions, and type of oil oil are some significant factors which will determine the extent of adverse impacts.

Mammals can also suffer fatalities resulting from spills. While some species may experience direct impacts, they could also be affected from ingesting oil during grooming activities. Scavengers and foragers could also eat oil-contaminated food, thereby ingesting petroleum. While ingesting hydrocarbons can be toxic to some species hydrocarbon ingestion in animals in general is not well understood at present.

D. Wetlands

Unavoidable adverse impacts to wetlands as a result of this proposed sale would be caused by oil spills and pipeline emplacement. Oil that may be spilled in the vicinity of the proposed lease tracts and does reach land would be primarily in the form of tar balls or heavy residues, whereas spills nearer to shore (from pipelines or tankers) may produce heavy coatings or patches.

Use of dredging equipment to remove contaminated marsh would impart further damage by increased turbidity and disturbance of mud bottoms. It may take up to several years for a dredged area to fully revegetate.

Oil spills which impact a salt marsh would kill vegetation and damage biological habitats from a few months to as much as several years before recovery.

Two to eight pipelines may come ashore, possibly crossing some marsh areas, causing short-term damage in 30 to 50 foot wide swaths. All vegetation and non-motile animals lying directly in the path of the pipeline would be killed during pipeline laying. Some slight damage may also be rendered to vegetation and marsh in adjacent areas by machinery used in the operation. Long-term impacts of crossing marshes may include salt water intrusion, possible alterations in localized flora, and increases in marsh erosion at the site where the pipeline crosses the marsh. If the pipeline crosses a fresh water marsh, which serves as a recharge area for a ground water aquifer(s), some local ground water supplies could be contaminated.

E. Beaches

Just as for wetlands, unavoidable adverse impacts as a result of this proposed sale would be caused to beaches by spills and pipeline placement. Offshore spills reaching land would be in the form of tar balls or heavy residues and spills nearer shore may produce heavy coatings or patches.

Heavily contaminated beaches will be rendered unsuitable for recreation so long as they remain coated with oil. Tar patches or balls would reduce recreational use until the beaches are cleaned. If any beach area is contaminated by oil, an undetermined amount of wildlife habitat would be damaged, primarily for birds, crustaceans, and molluscs. Oil

that is buried or seeps into sand may not be totally degraded over time, thus, possibly returning to the surface in the future and providing a problem for recreational use.

Removal of oil contaminated sand may lead to erosional problems unless enough materials are available to replace it.

If pipelines come ashore they will cause short-term destruction of all animals and plants lying directly in the pipeline corridor (30 to 50 feet wide swaths). Some slight damage may also be rendered to beaches in adjacent areas by machinery used in the operation. The shoreline will return to its natural state over a few tidal cycles in the swath zone, however, beach ridges and dunes may take up to several years to recover.

F. Water Quality

1. Offshore

Normal offshore operations would have unavoidable effects of varying degrees on the quality of the surrounding water if the proposal is implemented. Drilling, construction, and pipelaying would cause an increase in the turbidity of the affected waters for the duration of the activity, and, in the case of pipelines, could disturb settled pollutants in old dump site areas. A turbidity plume would also be created by the discharge of drill cuttings and the adherent drilling fluids. This, however, would only affect waters in the immediate vicinity of the rigs. The discharge of treated sewage would increase the levels of suspended solids, nutrients, chlorine, and BOD in a small area near the discharge point. Formation waters carrying mineral salts and regulated concentrations of hydrocarbons[1] would also affect the water quality of the area when discharged. In the high discovery case, the maximum water volume generated is large (2.6 billion barrels, 25 year total) and 78,000 barrels of oil could be introduced over the 25 year development period. This oil would create an incremental increase in the volume of oil lost to the sea each year. As such it could add to the overall deterioration of the ocean's quality. All of the above discharges are regulated by proposed OCS Orders and EPA regulations.

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[1]Present limits are set at 50ppm. After 1977, the limit will be 48ppm, after 1983, it will be 30 ppm.

In the case of an accidental spill or pipeline break, unavoidable deleterious effects would result. Spilled oil that is not recovered would release hydrocarbons and trace metals that could have toxic or narcotic effects on any nearby life forms as it dissolves and evaporates. The quality of the surface, near surface, and to a lesser extent, deeper waters would therefore deteriorate during the life of the spill. If oil is entrapped in bottom or shoreline sediments this degradation would continue over weeks or months as the oil is slowly reintroduced into the system.

2. Onshore

Increases in the population, commercial, and industrial sectors would undoubtedly add to the pollutant loadings of the waters of the region. Increases of 10 to 100 percent in municipal sewage loadings and industrial effluents could occur (Section III.D.2.e.), but their effects would be at least partially mitigated by the enforcement of permit programs for point sources and more stringent water quality standards. The water pollution resulting from the runoff from new construction sites would also be an unavoidable effect. This non-point source pollution does not fall under EPA jurisdiction and is difficult to prevent or control. Estimates of volume are not possible at this time.

G. Air Quality

1. Offshore

Normal offshore operations will have unavoidable effects on the quality of the air surrounding rigs and platforms but because of the isolation of the structures, the low levels of emissions, and the prevailing winds, any increase in pollutants would be incremental and the overall air quality would not deteriorate. In the case of an accident, oil and gas would be introduced into the environment and unavoidable, deleterious effects would result. Escaping natural gas would introduce methane, hydrogen sulfide and other hydrocarbons into the air. These, however, would disperse almost immediately. If the gas burned, carbon dioxide, water vapor, nitrogen oxides, and sulfur dioxide would be produced. If a gas pipeline leak occurred near shore, the sulfur dioxide and nitrogen oxides could cause problems of malodorous smells, depending on the volumes released. If the accident involved oil, either an accidental spill or pipeline break, various types of hydrocarbons would volatilize and mix with the air mass which could produce toxic or narcotic effects on the local biota. If the oil burns, carbon dioxide, water vapor, sulfur dioxide, particulate carbon, nitrogen dioxide, and partially oxidized compounds would be produced and would lower the existing level of air quality in the area. If this occurred near shore, the pollutants would also create problems

of haze and soiling on land. The actual degree of degradation is not predictable at present.

2. Onshore

Increases in the population and the commercial and industrial sectors during peak production years (around 1990) as a result of the proposal would undoubtedly add to the pollutant loads of the air. Most of these effects, however, would be mitigated by EPA's emission controls for automobiles, air emission guidelines for industries, and limitations on the allowed increments of pollutants in various areas (non-significant deterioration of air quality limitations). If most of the development occurs in metropolitan or industrialized areas only incremental percentage changes in air quality would occur. These increases could cause significant problems only in those localities in which standards were being exceeded at the time. However, if development occcurs in the less densely populated and less developed areas within the region, greater percentage increases will result although, since the air quality in these areas is good, the actual effects would be modified by a large dilution factor. Temporary, localized increases in levels of hydrocarbons and carbon monoxide, due to the increase in automobile and truck traffic, would be especially notable. In both cases, the rise in levels of sulfur oxides resulting from treatment of gas at the processing plants would represent the greatest change. In no

area would the increased activity be expected to cause air quality standards to be exceeded if they were not being exceeded already.

Since onshore development is anticipated to take place in areas with varying degrees of industrialization, population density and ambient air quality, a combination of the impacts described above could occur. However, the extent of development which may take place in major metropolitan areas is expected to be limited. In addition, it is expected that the majority of the onshore activity will occur in New Jersey, Delaware, and to a lesser extent, Maryland.

H. Land Use

The impact of facilities and growth induced as a result of the proposal, and their effect on land use could be significant on a community or sub-county basis, but it is perhaps the most susceptible to mitigation of all sale-induced impacts.

Unavoidable land use impacts, such as those resulting from pipelaying and other land disturbances are localized and short-term in nature, affecting 50-100 foot corridors or individual parcels of land. Long-term commitment of between 160 and 645 acres of land for OCS-related facilities,

as well as an additional amount of land as a result of incremental induced development and population, is unavoidable. Only a maximum of 265 acres of land are expected to be required in the coastal area. The greatest amount of development is anticipated to occur in the New Jersey coastal counties, from Monmouth to Cape May. Development may also occur, probably to a lesser degree, in the New York City area, counties surrounding Delaware Bay, and the northern Maryland Eastern Shore.

Possible long-term land use conflicts which could result from this sale, such as conflicts between different adjoining land uses and competition for different uses, are usually avoidable through exercising existing regulations and controls. The implementation of coastal zone management plans in 1977 should allow further prevention of land use conflicts in coastal areas. In addition, Delaware, Maryland and New Jersey presently have coastal zone or coastal facility siting legislation which should provide mechanisms for planning or planning decisions prior to implementation of coastal zone management plans.

I. Socioeconomic

Increases in the population of a particular area due to net in-migration as a result of direct investment in

the area, in addition to the locating of primary industrial facilities to support the action cannot be avoided should the action be taken and recoverable amounts of oil and gas be found. Primary facilities include exploratory rigs, platforms, terminals, storage facilities, onshore operations bases, gas processing plants, and service support facilities.

Population increases would be directly related to the locational and investment tendencies associated with these facilities. Up to 4200 to 15,400 jobs could be induced by the action of which up to 900 to 3600 would be primary jobs. The population increase associated with the induced jobs could be as much as from 5600 to 20,000 persons for the region as a whole. Unavoidable adverse impacts upon the physical and service system infrastructure as a result of OCS-induced population impacts would depend upon the availability, capability and elasticity of the infrastructure system of the area in which the induced population growth takes place. Visible adverse impacts, such as overutilization of infrastructure systems, inability of the systems to absorb and/or accommodate the additional population (up to 10 percent on a county basis from base case levels), will be most pronounced in areas having limited or underdeveloped infrastructure systems and/or comparatively small populations (Type III and IV areas, as described in Section II.G.).

In large highly urbanized and industrialized areas (Type I and II areas) the influx of population would not be as great (less than 1 percent from base case levels), due to labor force availability within the area. Because of the larger existing population, OCS-associated increases would not be perceptible. The ensuing infrastructural impacts, though unavoidable, would be negligible. Heavy private investment ( up to 200 percent greater on a county basis from base case levels) in an area where the level of existing economic activity is light and of a limited nature (Type III and IV areas) may cause significant impacts upon the quality of life experienced by persons in that particular area.

The migration of labor, capital, and materials to primary impacted areas from areas outside and within the Mid-Atlantic coastal region during the early years of oil and gas operations, and the subsequent out migration of some of these resources during the later years cannot be avoided should the action be taken and recoverable amounts of oil and gas be found.

When a given area is unable to absorb needed increased infrastructure expenditure and economic activity and excess resources are unable to be shifted elsewhere, problems in

the form of shortages of supply and dislocations in local economies may result. Allocational problems with regard to the pattern and nature of the production of goods and services may occur. Consumers within the locality may be affected adversely. Consumption patterns on the demand side, as well as production patterns on the supply side will need to shift so as to remove excess demand. The adjustment of a local econmy to spot shortages in its economy requires time. The adjustment is not immediate and dislocations may be experienced as a local economy works its way to equilibrium. Areas with low population densities and limited industrial bases (Type III and IV) would be the most likely areas to experience such adverse impacts.

As previously indicated, onshore activities are expected to occur primarily in New Jersey, Delaware, and possibly Maryland. Because of the diversity of the coastal regions of these states, development could be expected to occur in areas with varying degrees of industrialization and population density, although probably only to a limited extent in any major metropolitan area. Therefore, a combination of the impacts described above could be expected to occur.

A condition of uncertainty and less than perfect information will also create unavoidable adverse impacts. To the degree that decisions are based on predictions or estimates that prove to be in error over time, adverse impacts will occur to firms in the form of commercial ventures that do not cover their costs. It is not likely that uncertainty could be completely removed from the decision making process. Uncertainty with regard to the level of recoverable resources in the leasing area, the actions of others, and the economic climate is sure to remain. Private industry and government, while basing their decisions on as much information as possible, will be unable to avoid the adverse impacts caused by uncertainty. Inefficient use of resources could also result from a lack of coordination between the private and public sectors and the improper sequencing of decisions on all levels.

J. Recreation and Tourism

Oil spills (including those from pipelines) which may occur as a result of OCS oil and gas operations could result in unavoidable adverse effects on recreation and tourism interests. Since recreation is the predominant use of shoreline in much of this region, it is possible that the oil from any such spill could beach in areas that are used for recreation purposes. Such occurrences could result in the localized short-term curtailment and/or dislocation of recreation participation. The magnitude of the effects on recreation opportunities could vary significantly based on a number of relevant factors: the size of the spill, location of the beaching, and time of the year.

Although adverse effects on recreation are not certain to result from oil spills, and actions can be taken to minimize their likelihood, they are nevertheless not totally avoidable.

The major onshore facilities associated with OCS oil and gas development will not result in unavoidable effects on recreation opportunities. The facilities have the potential to generate adverse impacts but such potential can be eliminated through mitigatory actions.

K. Commercial and Sports Fisheries

1. Commercial Fisheries

Commercial fishing operations can suffer interference and inconvenience from oil and gas operations in several ways. Due to platform placement, some areas may become unavailable for harvest. It is estimated that a maximum of 250 acres might become off limits to commercial fishing operations during the production phase (Section III.A.3.b.). Trawl nets could become snagged on underwater stubs and unburied pipelines, causing damage to, or loss of, the nets. Less frequently, large objects accidentally lost overboard from petroleum industry boats and platforms are caught in trawling nets, resulting in damage to the net and/or its catch of fish. The frequency of occurrence of this type of incident, however, is low.

Spilled oil could coat or contaminate commercial fish species. Tainting of a fishery product might occur, although infrequently, and affect a localized area. A single incident could adversely affect market-

ability of certain species over an extended period of time. Data on the depuration of fish and shellfish species presently is not conclusive on this matter. Due to a major oil spill or chronic minor oil spillage, commercial and recreational harvest of intertidal shellfish could also be restricted and perhaps lost entirely for unknown lengths of time due to a combination of lower quantity and to the health hazard of tainted products.

2. Sport Fisheries

Oil spills (including those from pipelines) that may occur as a result of proposed OCS oil and gas operations could have unavoidable adverse effects on sportfishing opportunities. Opportunities could be curtailed by the spill-induced dispersal of fish population concentrations. Additionally, the tainting of fish and the potential soiling of equipment (that is, boats and tackle) could deter participation.

The major onshore facilities associated with OCS oil and gas development will not necessarily cause unavoidable adverse effects on sportfishing opportunities. The potential adverse impacts of these facilities, such as severe turbidity from surface runoff, can be at least partly mitigated by State and local standards and controls.

L. Shipping and Navigation

Interference between offshore structures and vessel traffic will occur, but it will be minimal. An estimated maximum of 50 plat-

forms will be necessary to develop the proposed lease area. Only a small portion of this acreage will be utilized by platforms. Approximately 62,600 acres, amounting to seven percent of the total acreage, lie within or in close proximity (less than six miles) to the existing traffic lanes. There is a greater propensity that any structure/vessel accidents that may occur in the area, will involve vessels not traversing the traffic lanes. In addition, approximately 27 percent (233,420 acres) of the proposed acreage to be leased is in or near an area extending from the Cape Henlopen to Five Fathom Bank traffic lane which is a heavy traffic area. This area and many others which crisscross the Mid-Atlantic offshore area have traditionally been used by ocean-going vessels but have not been officially established as traffic lanes. There is also a higher probability of accidents occurring in these heavy traffic areas.

Presently there are no regulations in force which absolutely preclude the placement of offshore structures in existing traffic lanes, but based on past precedents in the Gulf of Mexico and Southern California, oil drilling and production operations within traffic lanes will probably be restricted by the U.S. Army Corps of Engineers and the Coast Guard in order to assure minimal navigation interference. All offshore facilities will be equipped in accordance with United States Coast Guard regulations and the majority of them will be located several miles from traffic lanes.

Small craft traffic will have to detour around platforms and/or temporarily shut-in wells. Any other interference will be minimal as small craft are generally limited to daylight hours when visibility is generally adequate for line sight navigation.

M. Historical and Archeological Resources

Unavoidable damage to historical remains would occur when structures are not preserved or are not identified in time to take action for their preservation. Archeological sites or artifacts may not be detected with total certainty by surveys. Those which remain undiscovered will be damaged or destroyed partially or wholly if excavation occurs. The incidence of damage on the Outer Continental Shelf is likely to be low, but is potentially higher than in the coastal zone.

Other damage to archeological resources could come from oil contamination. Historical and archeological materials soiled by an accidental oil spill may not survive subsequent cleaning and restoration efforts. Porous materials could be rendered unsuitable for carbon dating techniques. The probability of such a polluting event occurring and interacting with artifacts is low, and the potential for significant resource destruction appears small although it does exist.

## VI. RELATIONSHIP BETWEEN SHORT-TERM USES OF MAN'S ENVIRONMENT AND ENHANCEMENT OF LONG-TERM PRODUCTIVITY

The proposed leasing of 876,750 acres of the total 6.5 million-acre Baltimore Canyon Trough area is the first Federal oil and gas leasing proposal in the Mid-Atlantic OCS. In general, the leasing for oil and gas development as a result of this proposal would not result in any large tradeoffs between short-term uses of the environment and the long-term productivity of the environment with regard to a specific natural resource. Rather, it will result in tradeoffs, in both the short-term and the long-term, between the use and allocation of different resources, as well as the effects on different resources.

The principal exception would be the use of extracted oil and gas resources, expected to range from 0.4 to 1.4 billion barrels of oil and 2.6 to 9.4 trillion cubic feet of gas. The extraction and consumption of mineral resources would preclude their use at a later date and lower reserves in the long-term, since at least in the human timeframe, oil and gas are nonrenewable resources. The short-term use of oil and gas resources over the estimated 25-year field life of this proposed sale would not, however, necessarily affect long-term development and production or availability of energy sources in general, or the long-term productivity of the environment. This would especially be the case should either no oil and gas be discovered, or if oil and gas are not found in commercial quantities as a result of this proposed sale.

However, this proposal could result in the discovery of recoverable resources over the high end of the estimated range range (2.6 billion barrels of oil and 12.8 trillion cubic feet of gas, see Section III.A.1.), thereby opening this area to successive future sales similar to events in the Gulf of Mexico. If this should occur, that period considered short-term (25 years) could extend considerably beyond this timeframe, to 30 to 40 years, and therefore could be considered as having long-term effects on the productivity of the offshore and onshore components of the Mid-Atlantic environment. Such future sales and the resulting extension of OCS-related oil and gas activities in this Mid-Atlantic region could especially effect the long-term productivity of the biological communities, fishing activities in the vicinity of offshore facilities. and onshore areas utilized for facilities directly associated with OCS operations and support facilities by extending the periods of impact as discussed previously in Section III.

With regard to this proposed OCS Sale No. 40, induced development and a population increase of up to approximately 2100 persons regionally may result in short-term adverse impacts to communities, especially if new OCS-related facilities are located in areas of low population with little current industrial base. A strain on existing infrastructure could be expected in these areas. However, in the long-term, a return to equilibrium can be expected, as population gains and induced industrial development are expected to be more dispursed in later years of development.

Incremental long-term gains in levels of employment and per capita income can be expected to accrue.

Short-term impacts to the marine coastal environment would result from this proposed sale. There would ne short-term adverse effects as a result of construction operations, in the form of resuspension of sediments, turbidity and land disturbance affecting local populations of organisms. Short-term adverse affects to these populations would also occur as a result of oil spills.

Short-term impacts could also occur to the recreation values and tourism economy of the area if an oil spill of considerable size should occur.

There would also be an unknown amount of long-term degradation of the environment due to the continuous introduction, through operations, of small amounts of oil and other substances, such as trace amounts of heavy metals from drilling muds, into the marine and coastal environment over the life of this proposed oil and gas operation. Evidence available at this time does not indicate any long-term adverse impacts on biological productivity as a result of the introduction of such substances into the environment, however, it is not possible at present to conclude that no adverse long-term impacts would result.

In addition, the short-term use of the OCS for mineral extraction will preclude fishing in the immediate vicinity of oil and gas operations, removing a maximum of 3240 acres at any one time from commercial fishing activity.

Up to 645 acres of land utilized for facilities directly associated with OCS operations will be excluded from other uses over the 25-year life of the field; however, only a portion of this land area may continue to so utilized after production ceases.

In summary, short-term localized adverse environmental and socio-economic impacts would result from this proposed OCS Sale No. 40. Long-term adverse environmental effects can also be expected, potentially some which are unknown at this time. Oil and gas reserves would be lowered as well. Few long-term productivity or environmental gains with regard to natural resources are expected as a result of this proposed sale. Benefits as a result of this proposed action are to be expected in other realms--principally those brought about as a result of increased supplies of domestic oil and gas.

It should be noted, however, that since this proposal would be a first sale in a frontier area, this action could lead to future sales in the area. While a decision to hold a sale is made on an individual, sale-specific basis, a sale in a frontier area, if resources are discovered, would undeniably provide incentive for additional sales. Any future proposals for additional sales in the Mid-Atlantic is subject to the same procedures to which this proposed sale is subject, including environmental assessments, and environmental impact statements. Section III.H. contains an analysis of the cumulative impacts of proposed Sale No. 40 and additional Mid-Atlantic sales.

## VII. IRREVERSIBLE AND IRRETRIEVABLE COMMITMENT OF RESOURCES

### A. Mineral Resources

Leasing of the proposed tracts in this sale would permit development and extraction of the oil and gas resources contained therein. Estimates by USGS of net recoverable resources range from 0.4 to 2.6 billion barrels of oil and from 2.6 to 12.8 trillion cubic feet of gas. More than one mineral lease may be issued for the same area for the retrieval of other types of minerals, but CFR 43, Part 3307, 4-5 provides that other leases may not unreasonably interfere with or endanger operations of any existing lease. We anticipate that mining of sand will not take place in the proposed lease sale area for many years; however, pipeline routes may cross potential sand and gravel mining sites, thus removing a portion of them from eventual use during the period of production anticipated over the life of this field. Leasing the proposed tracts could represent an irreversible and irretrievable commitment of hydrocarbon resources.

### B. Land Resources

The proposed sale would require up to approximately 645 acres of land for OCS-related facilities, as well as acreage for pipeline rights-of-way. In addition, an undetermined amount of land to accommodate induced population growth would be required. Potentially, additional land for facilities stimulated in part by this proposed sale could also be required. Land use requirements for induced population growth have not been estimated because they would

depend in part on how much of the population increase could be absorbed by existing excess capacity (in housing for example) in localities which receive the increases.

While these uses may be long-term, they are not generally considered irreversible. However, where new land uses result in the disruption or destruction of natural features or processes, such that return to the previous land use is not possible, an irreversible commitment of resources would occur. An example of such a commitment would be the conversion of wetland areas to other uses. Because of the relatively small amount of acreage required and the land use controls available to states and localities, we do not believe that such an irreversible commitment of resources would result from this proposed sale.

C. Fish and Wildlife Resources

An irreversible or irretrievable commitment of fish and wildlife resources and their habitats could occur in the area of a massive oil spill or if frequently subjected to chronic low levels of oil pollution. It is anticipated, however, that an affected area will recover from a spill and that the natural flora and fauna would eventually reoccupy spill areas. A possible exception may be with endemic endangered species. Irreversible and irretrievable commitment of an endangered species may result if populations of a species are initially affected by spills, through food contamination, or any other disruption or disturbance that may result from the proposed sale.

At the present time, there is insufficient evidence to conclude that low-level spillage or other activities associated with the proposed sale can lead to an irreversible commitment of fish and wildlife resources.

D. Economic Resources

A decision to proceed with Sale #40 would result in the production of certain OCS-related goods and services, including investments in required facilities, stimulation of certain industries within the region, and if recoverable resources are proved, oil and gas. To the extent that resources would be drawn away from other uses, production of goods and services in other areas or of other types would possibly have to be foregone. Steel products, specialized manpower, and capital constitute required resources which may be the scarcest, and use of these resources to develop this proposed Baltimore Canyon sale area could mean that other opportunities for their use might have to be foregone. While these resources may be reclaimed over time, their use as a result of this proposed sale would constitute an irreversible and irretrievable commitment of resources at a given point in time.

To the extent that unemployed resources are used, the employment of resources as a result of this proposed sale would not constitute a cost to society in the form of foregone opportunities. For example, our analysis indicates that unemployment in the region may drop by .08 percent in 1985 as a result of this proposed sale (high discovery case), suggesting that some labor would be drawn from the ranks of the unemployed.

E. Human Resources

Since 1970, when detailed reporting regulations were implemented by the U.S. Geological Survey, there have been 200 human casualties directly associated with offshore drilling operations, seventy-six of these casualties resulting in death.[1] It will be impossible to avoid all human casualties, but they have been minimized through measures already implemented which are continually updated to improve the safety of OCS operations. Fatalities and/or permanent impairment as a consequence of accidents and personnel error will result in an irreversible and irretrievable commitment of human resources.

F. Archeological and Historical Resources

Any damage to archeological and/or historical sites and artifacts either known or undiscovered would result in an irretrievable commitment of nonrenewable resources. Their usefulness and value would be either lessened or lost as the result of oil spills or construction damage.

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[1]Includes casualties up through the first six months of 1975.

## VIII. Alternatives to the Proposed Action

### A. Hold the Proposed Sale in Modified Form

#### 1. Delete Tracts From the Proposal

Of the 3.2 million acres nominated by industry (557 tracts), only a little more than one-third of that (876,750 acres - 154 tracts) has been tentatively selected for this proposed sale (Section I.C.).

In order to reduce the potential and magnitude of environmental and onshore impacts, one alternative might be to reduce the size of the sale by deleting specific tracts. An examination of the proximity analysis (Section III.E-G) reveals that because of their distance from shore, no tracts fall into the "high hazard potential" category; however, due to use of the entire area for fishing and shipping, all the tracts fall into the "high potential for disturbance" grouping. It should be noted that all tracts or areas which received negative nominations[1] on the basis of specific scientific knowledge or intense multiple-use limitations were omitted (Figure I-2). No additional tracts could be deleted on the basis of these negative nominations. And, as shown in the OCS Oil Spill Risk Analysis in Section III.A.4., the variation in environmental risks within the entire proposed lease area are minimal.

The only remaining criteria which might be used to delete tracts is the separate locational grouping of tracts already selected; these fall into a northern and southern area of 660,409 acres and

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[1] Response to Call for Nominations, Mid-Atlantic

216,341 acres, respectively. Because no information is publicly available on the potential undiscovered resources of these two groupings of tracts, no precise estimate can be made on the potential environmental impacts of holding separate sales for each grouping.

In general, a sale of 216,341 acres (38 tracts) mostly offshore of Delaware (Figure VIII-1) might result in a much smaller amount of produced oil and/or gas, (it is less than 25 percent of the entire proposed area), perhaps only one pipeline corridor needed to carry production to the existing refineries in the Philadelphia area (or less likely, tanker traffic to regional refineries), somewhat reduced environmental effects from oil pollution, smaller amounts of drilling muds and resuspended sediment and their environmental impacts, substantially fewer wells drilled, and fewer platforms (thus, fewer impacts on fishing and shipping). Induced onshore effects would be smaller with fewer operations bases needed (perhaps only one or two either in southern New Jersey, Delaware, or Maryland, or possible Virginia), fewer gas processing plants, a smaller OCS-related employment rise with fewer skilled personnel entering the region, lower increase in oil and gas development-generated regional income, and less potential impacts to the coastal and uplands natural environmen from displacement or disturbance of ecosystems. However, if only this smaller southern area were leased, the area of possible onshore impacts could shift more to the south from the coastal New Jersey counties.

A sale of the larger grouping of 116 tracts offshore New Jersey

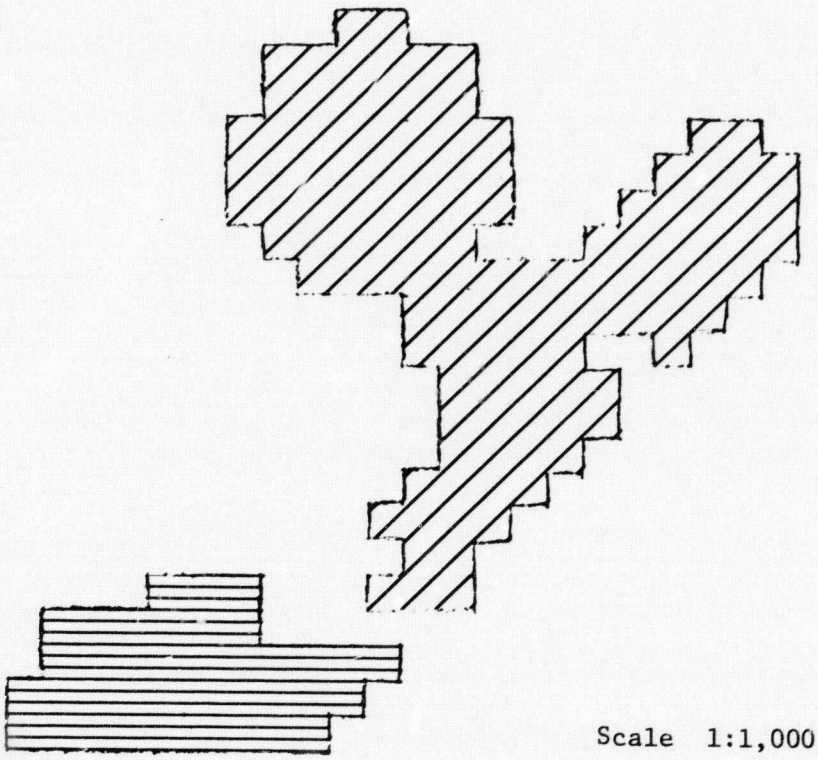

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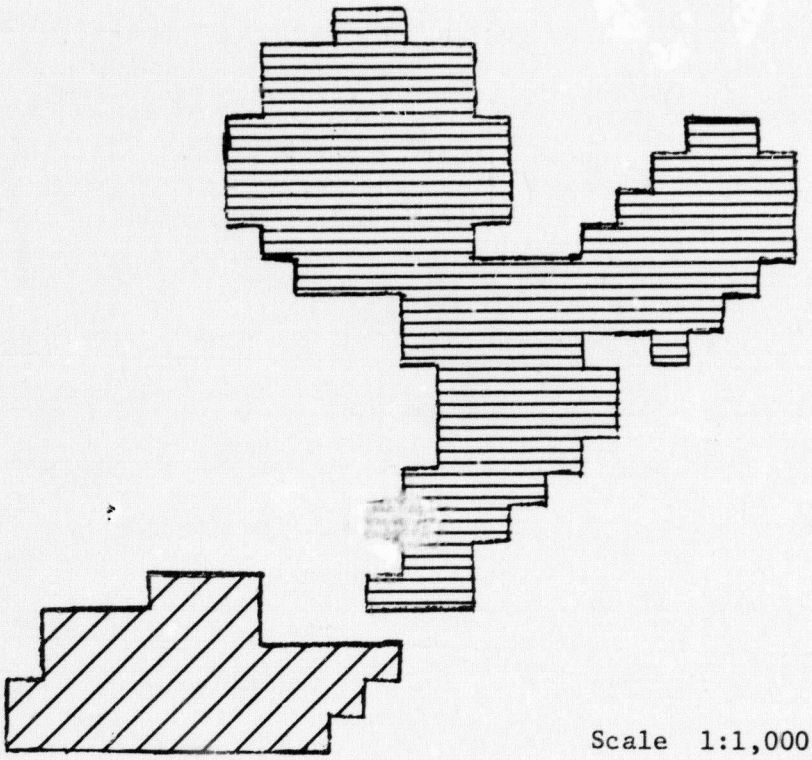
Figure VIII-1. Alternative Leasing Proposal. Horizontally ruled tracts are the alternative proposal. Diagonally ruled tracts would be deleted.

(660,409 acres) (Figure VIII-2) could only modestly reduce the potential environmental and socio-economic impacts from petrolem development. It might be expected that a one-quarter reduction in the number of tracts would result in a smaller amount of produced oil and/or gas, perhaps a maximum of 4 or 6 pipelines going to the existing refineries in New Jersey and the Philadelphia area (or less likely, a reduced amount of tanker traffic) and to gas processing plants, somewhat reduced environmental effects from oil pollution, lesser amounts of drilling muds entering the environment, lesser amounts of resuspended sediment with their environmental impacts, fewer wells drilled, and fewer platforms. Induced onshore effects would be less with fewer operations bases needed (perhaps a maximum of 2 or 3 located in New Jersey, New York, Delaware, and/or Maryland), fewer gas processing plants, a smaller OCS-related employment rise with fewer skilled personnel entering the region, lower increase in oil and gas development-generated regional income, and less potential impacts to the onshore natural environment from displacement or disturbance of ecosystems.

One other possible alternative would be to delete the northwest portion of the northern group of tracts in addition to the southern group of tracts (Figure VIII-3). This would provide an intermediate size sale between the other alternatives mentioned above--387,137 acres (68 tracts). The closest tract distance from shore would be 65 miles thereby possibly increasing the time any oil spill would take to reach shore. A sale of this size would result in basically the



Scale 1:1,000,000

Figure VIII-2. Alternative Leasing Proposal. Horizontally ruled tracts are the alternative proposal. Diagonally ruled tracts would be deleted.

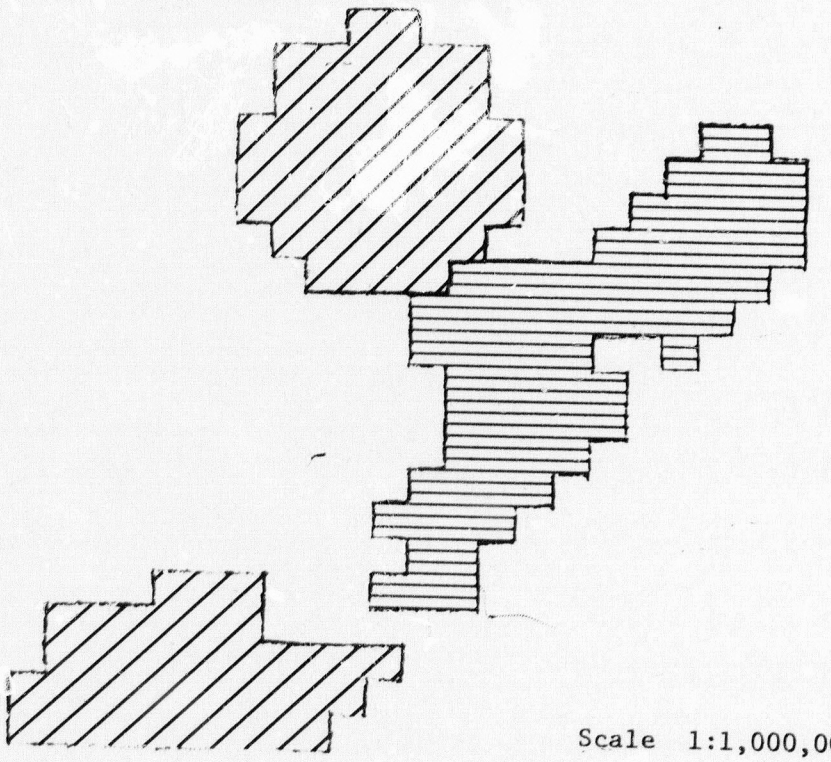


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Figure VIII-3. Alternative Leasing Proposal. Horizontally ruled tracts are the alternative proposal. Diagonally ruled tracts would be deleted.

same impacts as described for the 116-tract second alternative above although possibly on a reduced scale. For example, only a maximum of two to four pipelines might be required to carry production to refineries, a maximum of perhaps two operations bases might be used, and the amounts of pollutants released to the environment may be decreased.

One possible advantage to holding a smaller sale would be the opportunity for gradual adjustment of the region to offshore activities. Discovery of oil and gas is uncertain for the entire proposed 154-tract sale area; if no shows are found in the exploration phase of a small-size sale, the necessity for future sales might be eliminated and the effects of any possible "boom and bust" cycle reduced. It should be pointed out that Federal lease sales in the Gulf of Mexico before 1960 ranged in size from approximately

82,000 to 740,000 acres (U.S. Department of Interior, 1972) with the first sale in 1954 being the highest figure.

Adverse impacts from not holding a larger sale would affect the socio-economic environment. The reduction in potentially producible oil would increase the amount of time which the United States, and the Atlantic coastal States particularly, would continue to be reliant on foreign sources of petroleum. The reduced possible increase in oil and gas-related employment and lower increases in local and regional income would negatively impact those areas already suffering the effects of high unemployment and declining income.

Continued reliance on imported oil shipped into the region by tanker would be harmful to the natural environment as a result of future tanker oil spills.[1] The smaller amount of produced natural gas and overall delay in producing potential OCS resources could also result in more use of coal or oil fuels for heating and industry. Additional delays in reducing air pollution consequently would adversely affect human health, and some industries which cannot afford to change to other fuels or which can only use natural gas may have to close (thus worsening the impact on the regional economy).

Because of the unknown distribution of oil and gas in the proposed lease tracts, the potential bidders may not undertake a large overhead investment for a smaller proposed lease area. If the size of a

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[1] As noted throughout this statement, pipelines are expected to be the primary means for transportation of oil and gas in the proposed sale area. Tanker transporting, while possible, is less likely or desirable.

find in a smaller amount of acreage is small, it may not be produced because it would not be economically feasible; however, if several small finds are present in a larger amount of acreage, such as this entire proposed leased area, the total amount of oil might then be economically feasible to produce. Additionally, the reduction in sale offering may affect other potential sale sizes in the Atlantic and, if there is little evidence of oil in one sale area, could possibly eliminate sales and incoming revenue to the government in other OCS areas.

2. Substitute Tracts

a. Within the Call for Nomination Area

Of the 557 tracts which received nominations from the petroleum industry, there are 164 tracts that are either intensely used by commercial fisheries, within NASA rocket trajectories off Wallops Island, wholly within navigation traffic lanes, contain unexploded ordnance, or have potential geological hazards (refer to Visual 1 and Section I.C.). These tracts would pose added risk to the environment, other uses of the OCS, or petroleum industry personnel.

The remaining 239 tracts (1,376,640 acres) nominated by the industry not included in this sale proposal for leasing in the Mid-Atlantic are shown in Figure VIII-4. These tracts could be alternative leasing areas for the proposed sale. They range in distance from shore from 34 to 190 kilometers (21 to 120 miles) and lie in water depths of

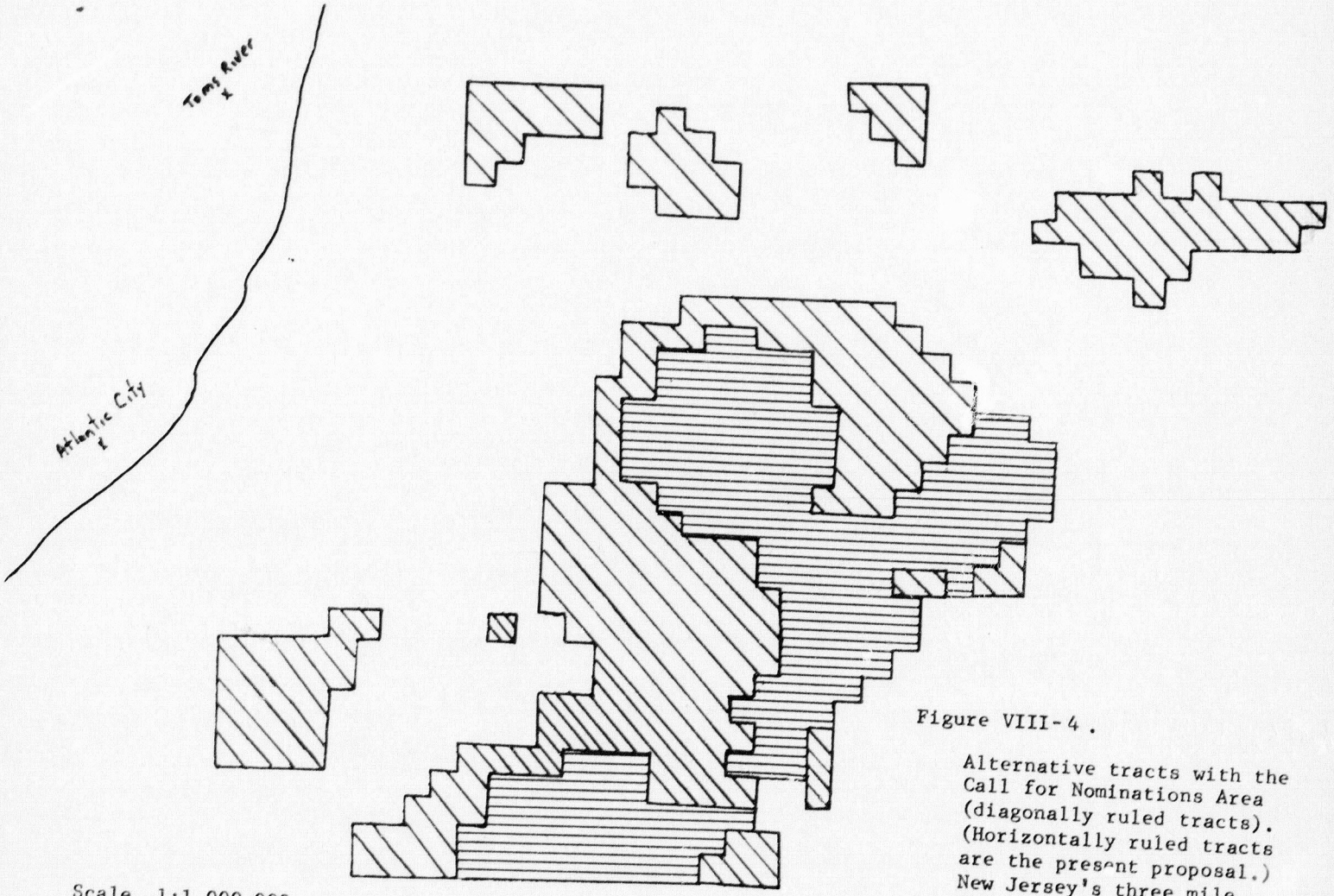


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Figure VIII-4.

Alternative tracts with the Call for Nominations Area (diagonally ruled tracts). (Horizontally ruled tracts are the present proposal.) New Jersey's three mile limit shown by line at left.



511

approximately 30 to 200 meters (100 to 660 feet). These tracts were initially deleted because of low industry interest. The U.S. Geological Survey also felt that they held less promise for oil and gas development. At this time we can make no estimate of potential hydrocarbon resources contained within these tracts. To choose tracts located shoreward of the proposed leasing area might increase the potential for oil spills to come ashore if a spill originated at a platform. Because of the seemingly lower prospect for oil and gas to be found in these tracts, it would be necessary to offer more of them in order to provide an equivalent number of prospects for exploration or equivalent production levels of oil and gas. However, additional environmental assessment would have to be made regarding the possible substitution of any of these alternative leasing areas for any of the 154 tracts presently proposed.

b. Outside the Call for Nomination Area

The call for nominations area contains the thickest part of the Baltimore Canyon Trough and what may be the most prospective, easily identified structures (Section II.A.2.). Other alternate tracts which might be considered for leasing proposal in the Mid-Atlantic lie outside the call area, either very nearshore or on the Continental Slope.[1]

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[1] A site-specific environmental analysis would have to be made for these alternative leasing proposals.

Nearshore

Petroleum traps which might exist shoreward of the call area may be primarily stratigraphic - a reflection of updip-wedgeouts of the trough - sediments, unconformities, or possible facies changes. At this time we can make no estimate of potential hydrocarbon resources which might be contained within these tracts. Because of the need for extensive drilling to locate such traps and the lack of drilling data concerning seaward portions of the Trough, this alternative is not as viable as is the following.

Farther Offshore

Figure VIII-5 shows the location of a number of tracts which might be prospective on the Continental Slope. These tracts are located in approximately 200 to 2000 meters (660 to 6600 feet) of water No estimate can be made at this time of the undiscovered petroleum resources contained within these tracts. As mentioned in Section II.A.2., a thick section of sediments exists offshore of the basement ridge; possible reef structures may be good exploration targets.

Much less is known about the Mid-Atlantic Continental Slope than the Continental Shelf.[1] Available information indicates that the sea floor is covered primarily by silts and clays, deep sea canyons provide channels for sediment transport from the shelf, slumps are located in several locations along the slope, and sediment reworking is primarily biogenic.

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[1]BLM is presently funding a literature survey by TRIGOM to determine the extent of knowledge about the Mid-and North Atlantic Continental Slope.

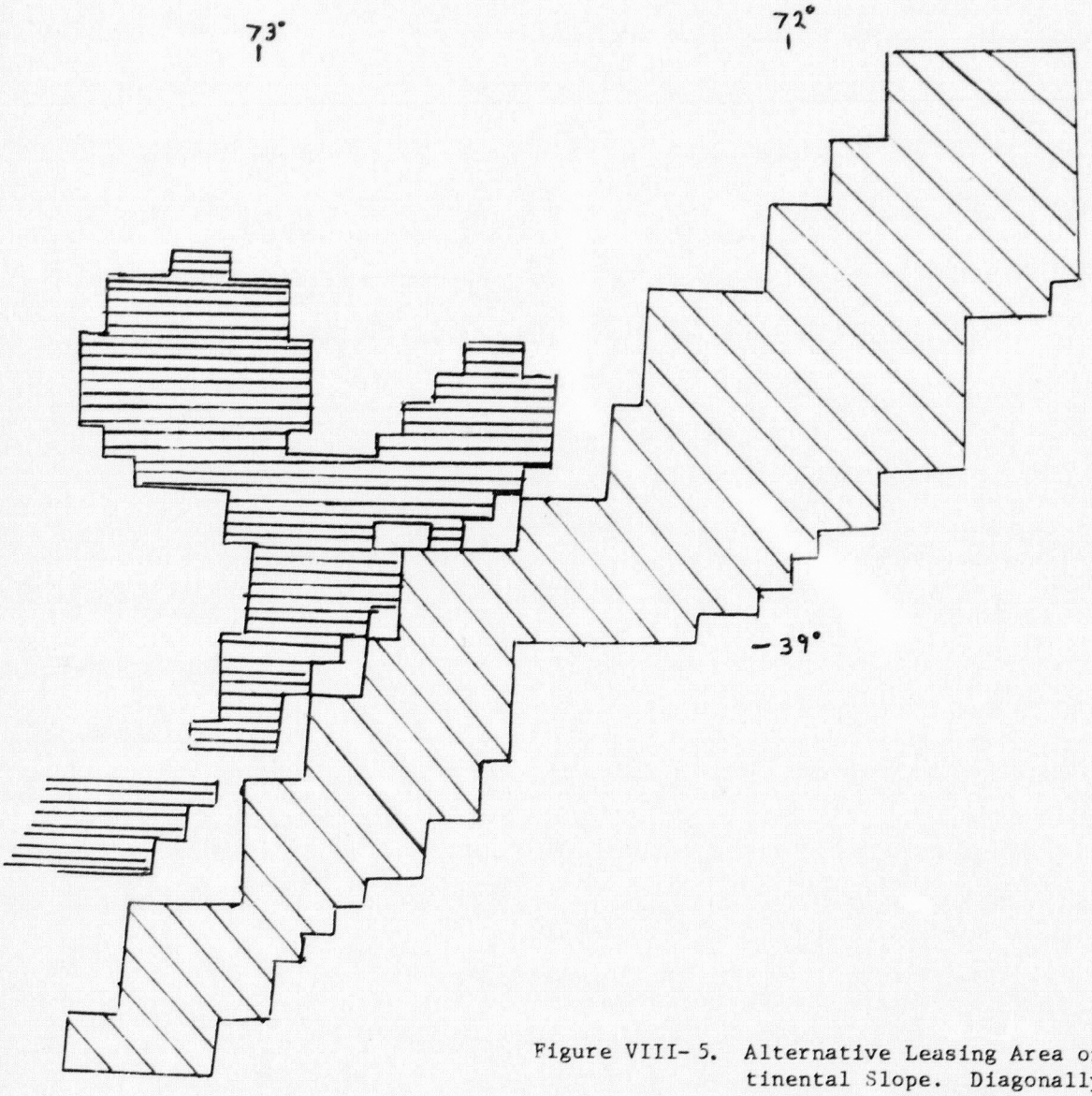


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Figure VIII-5. Alternative Leasing Area on Continental Slope. Diagonally ruled tracts are alternative tracts. Horizontally ruled tracts are tentatively selected.

Insufficient data exists to fully characterize biological habitats on the slope; however, it is known that the upper slope and canyon areas may have concentrations of organisms like crustaceans and echinoderms, benthic organism diversity may not be as great as on the Continental Shelf, and fish are present in sufficient numbers to support major fishing efforts. The fishing industry may increase its activities on the Mid-Atlantic slope as technological capabilities improve and certain species become better utilized (the red crab, for example). Weather and sea conditions on the slope may be expected to be similar to those described for Mid-Atlantic outer shelf areas. Water circulation is dominated by Slope Water (Visual 2). Chemical oceanographic conditions are not well known. Other than fishing, man's use of the Mid-Atlantic slope includes ship traffic and in specific locations, dumping grounds for acid waste and munitions (Visual 1).

Oil and gas production from the Mid-Atlantic Continental Slope would require the use of advanced technologies. Platforms for operations in over 1000 feet of water are presently planned for the Gulf of Mexico and production from even deeper water may be possible. However, because of problems of laying pipelines in such deep water initial production would probably have to be accomplished through the use of tankers. Engineering difficulties for the Continental Slope include bottom support for structures, the higher potential for slumping, and higher earthquake potential. Oil spills which occur at these greater distances from

shore would probably not reach shore, and those that did would most likely be in the form of tar balls or isolated oily patches. The numbers and sizes of onshore facilities might be the same as anticipated for a proposed sale on the Mid-Atlantic Continental Shelf. Operations in such deep water require much greater capital investment by industry than is required for shelf operations. As a consequence, drilling activity in the Mid-Atlantic might be at a much slower pace, the costs of producing oil greater, and time to begin production longer than if the presently proposed sale were held.

B. Delay the Proposed Sale

1. Pending Implementation of Coastal Zone Management Plans

Coastal Zone Management plans should be implemented by Mid-Atlantic states by November, 1977, and for those states in closest proximity to the proposed leasing area, plans should be implemented by June or July, 1977. This is between 10 to 15 months after lease sale #40 is proposed to take place.

All activities and facilities associated with production, such as pipelines, pipeline terminals, oil storage facilities and gas processing plants, as well as the full complement of support activities necessitated by successful oil and gas operations, will be undertaken subsequent to any initial discovery of producible reserves, which would be well after coastal zone plans have been implemented, even if completion of CZM state plans are delayed one year, as now is proposed before Congress.

For example, we do not anticipate any permanent onshore operations bases to be constructed prior to 1979. Investments in new facilities will not be made until their necessity is proven. In addition, the size and locations necessary and participants to be included in these ventures cannot be determined prior to the time when initial reserves are proven, which would take at lease two or three years. Therefore, most onshore activity will not commence until coastal zone management plans are implemented, under the existing proposed schedule.

However, some exploration-phase support activities can be expected to commence prior to the implementation of CZM plans. Support activities for oil and gas exploration activities will be required, but prior to construction of any permanent base or bases, such support is expected to operate temporarily out of existing port areas and facilities.

It is possible that the expectation of successful oil and gas activities in the proposed leasing area as well as the anticipation of oil and gas activities elsewhere on the Atlantic coast would stimulate speculation or buying of operations on coastal properties.

These activities could involve both prospective buyers and prospective sellers. While there are reports that such activities are currently underway, it is unknown whether and to what extent they are actually occurring.

It is difficult to assess the general effect of this early scrambling and guessing on the part of potential buyers, sellers or affected communities. New construction activity in defined coastal areas

is already controlled to some degree by the State in New Jersey, Maryland, and Delaware. In addition, siting of new facilities in all the states is a function of local zoning and other regulations. The extent to which the states will exert greater control over the siting of particular facilities and/or appropriate types of development for specific coastal areas will be a function of how this control is delegated under the evolving coastal zone management plans and the existing or proposed State regulations.

Wherever siting decisions are made in the future, however, they would be made in the context of more complete information about coastal zone resources and in the context of established guidelines which attempt to balance competing coastal zone uses and lines are a part of all the Mid-Atlantic States' coastal zone programs. This may be of particular importance in less developed counties and localities where planning resources have historically been limited. These same areas tend to have the least amount of zoning and other land use controls. So while the locus of decision making may or may not be changed under coastal zone management plans, the framework in which decisions regarding use of the zone are made should be a more informed one.

Nonetheless, the majority of OCS related activities onshore, as well as most of the activities with the largest potential impacts will occur after the implementation of presently evolving coastal zone management plans. Delay of the sale until 1977 would probably not

result in less early speculation or attempts by land owners to make a profit by selling land for OCS-related activities. The results of these activities might be different, however, on an individual basis, if zoning changes or different controls result in different permitted uses for specific parcels of land.

Another result of delaying the proposed sale until after coastal zone management plans are implemented would be to allow a longer period of time for coordination both between Federal agencies and the states and among the states themselves. Efforts are presently underway, under the general aegis of the Mid-Atlantic Governors Coastal Resources Council, to study potential OCS-related developments from a regional perspective. Delay of the sale would allow a longer time for the development of a coordinated regional response and/or planning for OCS-related development. If state coastal zone plans contain methods for implementing any planning or guidelines developed through this effort and/or if localities cooperate in the implementation of any guidelines developed, better planning decisions might result. In addition, the additional time might allow for more information to be generated or disseminated, allowing for more informed decision making.

2. Pending Completion of Studies Concerning Potential Environmental Impacts of Offshore Minerals Development

The proposed OCS Lease Sale No. 40 could be delayed until the completion of all the environmental studies presently ongoing or planned in the Mid-Atlantic. The timeframe for such a delay is of the order of from three to five years. The actual studies being carried out are described elsewhere in this document (Section I.D.2.). The program constitutes the first year of study and concentrates on measuring biological, chemical, and geological parameters. This program is expected to continue for at least another two years at its present, or at a more intensive level, and to continue beyond this period at a reduced level, all through exploration and production. In addition to th baseline monitoring program (the continuation of the first year's baseline study), plans are now being formulated to monitor at least some of the exploratory drilling operations which would occur in the Mid-Atlantic in the coming year if the proposed sale is held. This type of program will entail a series of small areas, intensive before- during- and after-drilling sampling periods, and will involve the type of studies presently included in the first year baseline study. Such rig-monitoring programs are already in operation in both the MAFLA and South Texas OCS areas. It should be pointed out that the stated purposes of the environmental studies program are:

a) To provide information about the OCS environment that will enable the Department and the BLM to make better management decisions regarding the development of mineral resources.

b) To provide a basis for predicting the impact of oil and gas exploration and development on the marine environment.

c) To establish a basis for predicting the impact of OCS oil and gas activities in frontier areas.

d) To provide impact data that would result in modification of leasing regulations. operating regulations, or operating orders.

Baseline and monitoring environmental studies programs have been underway in the MAFLA area since July 1974, South Texas since November 1974, and the Mid-Atlantic since June 1975. The first year of the latter study is expected to be completed in the late summer or early fall of 1975 with a final integrated report due by December 1976.

At the present time, the proposed Lease Sale No. 40 could take place in the summer of 1976, if a decision is made to hold the sale. If the proposed sale should take place, both geological hazards and any unique biological communities will have been identified and delineated. This data could and would be

used for prompt deletion of a tract or tracts prior to holding a sale. It should be emphasized that a proposed tract may be deleted up to and including the actual date of a sale as long as it is prior to the opening of the submitted closed bids. Cases in point are the deletion of certain tracts in the South Texas OCS area where drilling could have damaged the coral reefs in the Flower Garden area and the removal of tracts from the Gulf of Alaska Sale No. 39 because of dangerous environmental conditions which could have led to possible detrimental environmental impacts.

In addition, the existence or the amount of offshore oil and gas in the proposed sale area is still unknown; thus, the planned future studies, and the funds expended on them, could be unnecessary should insufficient oil or gas be found. If petroleum or gas is present, its production could be delayed for an additional period while awaiting the completion of all the baseline studies. This would increase U.S. reliance on foreign sources for that time period.

Finally, it is presently envisioned that the exploration phase of oil and gas development in the Mid-Atlantic area could take from two to seven years. If environmental studies are carried out during this period, all the possible stipulations, lease restrictions, or changes in OCS Operating Orders would be developed and would be specifically tailored to the Mid-Atlantic area so that during the

production phase, regional oil and gas resources could be most advantageously exploited while also providing maximum protection to the environment. The exploratory drilling phase is only likely to introduce very low levels of possible pollutants into the environment. Thus, it is not believed that a delay of the proposed sale, pending completion of the Mid-Atlantic environmental studies, would provide significant environmental advantages as long as exploration is accompanied by the ongoing program of environmental studies.

3. Pending Development of New Equipment to Provide Increased Environmental Protection

This sale might be delayed while awaiting new and significantly improved oil spill cleanup methodologies. The traditional approach to oil spill cleanup has been containment and later removal by absorption, adsorption, or skimming. Presently available equipment is adequate for calm or enclosed waters but fails in rough sea conditions of two knot currents and several foot waves (Boesch, 1974). (See Section IV.C.).

Booms are used for containment and various types are available. They normally fail when the accumulated oil behind the barrier is either carried underneath it by the current or over it by the winds and waves. Most of the booms available break apart in high sea states and are not easily deployable in rough weather. The Coast Buard has developed a High Seas Containment

Barrier that is capable of withstanding 20 ft waves and 7 knot currents (Boesch, 1974), and of operating well in 4-6 ft waves, 2 knot currents, and 20 knot winds (Atlantic Strike Team, 1974). It can be transported by plane or truck and deployed fairly rapidly. Exxon has developed a boom that has been shown capable of surviving in 20 ft waves, 2 knot currents, and 60 knot winds and of operating well in 6-8 ft waves, 1 knot currents, and 20 knots winds (CEQ, 1974b). However, the boom is cumbersome and not easily deployed. Improvements are being made but the effectiveness of booms is reaching its upper limit (CEQ, 1974b). In view of this fact the Coast Guard is now investigating the advisability of attempting to further improve the existing systems.

After containment, the oil must be collected. Straw is rapidly being replaced by mechanical skimmers and synthetic sorbents in this task. Skimmers operate on various principles and some types are now available that work well in 6-8 ft waves, 3 know currents, and 40 knot winds (Atlantic Strike Team, 1974). The Coast Guard is developing a combination boom and skimmer system, but this will not be available for some time. Synthetic sorbents include polyurethane foam, alkylstyrene beads and other coleophilic products. These absorb or absorb 5-30 times their weight in oil, and some can be wrung out and reused. The problem with sorbents is that they themselves must be collected either mechanically or manually to prevent them from contaminating the environment.

All of these methods are effective in calm harbor and nearshore waters but face severe limitations on the open seas, not the least of which are the 12 or more hours required to respond to a spill several miles offshore as might be the case in this proposed sale area. Oil spill containment on the open sea then is severely limited. Any improvements in the near future will only be refinements of already existing techniques; some as mentioned above are already approaching their upper limits of effectiveness. No new, different technologies which would affect our overall ability to protect the Mid-Atlantic environment are emanate in the near future, therefore, this is not thought to be a reasonable alternative.

4. Pending Completed Implementation of Recommendations Made in Reports on OCS Operating Orders and Regulations and a Review of Regulations and Amendments as Necessary

A decision could be made to delay this proposed sale until implementation of those recommendations made in reports concerning strengthening operating procedures has been completed. During the implementation of these recommendations, a review could be completed of all operating and leasing regulations, OCS Orders and statutory provisions to locate sections or areas of needed revision. Any necessary amendments of the regulations and orders could be made through the appropriate procedures and, if sections of the OCS Lands Act were found to need revision, amendments could be suggested to Congress.

In considering this alternative, the existing authority of the OCS Lands Act to prescribe and amend regulations any time the Secretary determines it to be necessary and proper so as to provide for the prevention of waste and conservation of the natural resources of the Outer Continental Shelf and the protection of correlative rights therein, must be kept in mind (43 U.S.C. 1334(a)(1)). Any revisions of the operating regulations or the OCS Orders which relate to the prevention of waste, conservation of natural resources, or protection of correlative rights, could be made at any time and apply to all existing leases.

The Department of the Interior has made several changes in its procedures since the 1969 Santa Barbara oil spill, and since receiving and acting on recommendations received in 1974 from the Council on

Environmental Quality and others. The U.S. Geological Survey has made revisions to the OCS Operating Orders and regulations (Section IV.A. and Appendix 11), offshore inspections have been expanded, and the offshore effluent limitation guidelines promulgated by EPA have been incorporated into the OCS Operating Orders. Additional participation has been solocited from both Federal and State agencies for input into the environmental impact statement prepared for each lease sale, such as this proposed Mid-Atlantic Lease Sale No. 40.

5. Pending Enactment of Legislation to Provide States With OCS Revenue Sharing and/or Compensation Funding

The proposed OCS Lease Sale No. 40 could be delayed until legislation has been enacted to provide a revenue sharing and/or a guaranteed loan or grant program to coastal States for financial assistance with their planning activities and compensation for public amenities expenses directly related to OCS onshore activities or facility siting requirements.

Such funding assistance could minimize financial burdens of the coastal States and localities regarding expeditious land use planning requirements related to onshore OCS-related facility siting, as well as financial burdens suddenly encountered in their furnishing any required supporting services and increased infrastructure costs (such as utilities, sewers, housing, police and fire support, and so forth).

Several legislative proposals have been introduced in Congress that would provide this type of assistance to the States. Legislation to amend the Outer Continental Shelf Lands Act of 1953 has been passed by the U.S. Senate (S. 521) that would provide a grant and loan program for coastal States. Also, legislation to amend the Coastal Zone Management Act of 1972 has passed both the U.S. Senate and House of Representatives. H.R. 3981 would require the establishment of a coastal energy activity impact program to provide funds to coastal States relating to any energy-related activities, particularly OCS activities. S. 586 would authorize financial assistance to coastal

States for planning for and mitigating any energy development or facility siting that would affect the coastal zone. In addition, a proposed Administration bill has been introduced in the U.S. Senate that would provide guaranteed loans and planning grants regarding energy-related Federal proposals. This particular bill is designed to help meet the financial problem of front-end expenses (planning and supporting infrastructure) encountered by the States and localities.

The concept of the need for this type of funding support has been recognized, and it is felt that such financial assistance is possible and attainable in a manner appropriate to mitigate the impacts that would be encountered by the coastal States.

If this proposed sale is held, some exploration-phase support activities onshore would occur in the next year or two, however, these activities most likely will be relatively limited in scope and generally temporary in nature until such time as definitive quantities of oil and gas resources are discovered that would warrant further development, and accompanying expansion and establishment of more permanent facilities. If economically recoverable quantities of resources are discovered, as discussed in Section III.A.1., it would be up to three years or more before any development and production activities would commence--activities that would necessitate more extensive onshore facilities and support infrastructure.

Proceeding with this proposed sale would not preclude Congress from approving a revenue sharing and/or a compensation fund.

6. Pending Enactment of Legislation to Establish An Oil Spill Liability Fund

The proposed OCS Lease Sale No. 40 could be delayed until the enactment of an oil spill liability fund that would assure compensation for environmental and economic damage and losses from OCS-related oil spills that could impact the coastal zone.

A no-fault oil spill liability fund could compensate States, counties, localities, and private businesses for the environmental and economic losses that might result from damage to beaches, wetlands, and wildlife/fisheries resources, and would take care of clean up costs and rehabilitation and restoration, as well as any losses to businesses or livelihoods, no matter the origin of the OCS spill.

Several legislative proposals have been proposed in Congress that would establish such a fund. The U.S. Senate has passed S. 521, a bill to amend the Outer Continental Shelf Lands Act. One of the features of this proposed bill would be to establish an offshore oil pollution settlement fund that would be liable for damages caused by discharge of oil or gas by any OCS operations. The U.S. House of Representatives may soon take action on H.R. 6218, a bill proposed by the Ad Hoc Select Committee on Outer Continental Shelf. This bill proposes to establish an offshore oil spill pollution fund as one of its features. In addition, a proposed Administration bill introduced in both the Senate (S. 2162) and the House

(H.R. 2162) would provide compensation for oil spills from any source, including OCS operations. This proposed bill would set up procedures by which a quick no-fault settlement system would be established, and would specify eligible claimants and recoverable damages that would be allowed.

The establishment of such an oil spill fund or insurance program has been of great concern to many interests in the Mid-Atlantic States coastal region. The intense use of many of the beach areas in New York, New Jersey, Delaware, Maryland and Virginia for recreation uses is the basis for a strong tourism economy within this Mid-Atlantic coastal area.

Although oil spills are of concern at all times, they are of greater concern during actual development and production activities. In the case of this OCS Mid-Atlantic proposal, development will not commence until at least three years after a sale, if a sale is held (Section III.A.1.). It should also be noted that not one pollution incident of greater than 50 barrels has resulted from a drilling blowout since 1969 (USGS, Written Testimony, DES for Proposed OCS Lease Sale No. 40, 1976).

If this proposed sale were held prior to the establishment of oil spill liability legislation, subsequent legislation could be made applicable to operations out of leases that would be issued.

C. Withdraw the Proposed Sale

Another option is to cancel the proposed sale. This option would reduce future OCS oil and gas production and would thus necessitate continuing foreign imports or reducing energy consumption by reduced demand or supply shortfalls, or developing alternative energy sources, or some combination of these.

It is anticipated that the oil and gas that would become available from this proposal in the next 25-year period could provide significant additions to the nation's domestic production, particularly for use in the Mid-Atlantic area. However, if the subject sale were cancelled, the following energy actions or sources might be used as substitutes.

- Energy conservation
- Conventional oil and gas supplies
- Coal
- Nuclear power
- Oil shale
- Hydroelectric power
- Solar energy
- Energy imports
  - Oil imports
  - Natural gas pipeline imports
  - Liquefied natural gas imports
- Geothermal energy
- Other energy sources
- Combination of alternatives

This section briefly discusses these alternatives. For more detailed information on each of these energy sources and environmental impacts, refer to the study Energy Alternatives: A Comparative Analysis, prepared for the Bureau of Land Management by The Science and Public Policy Program of the University of Oklahoma. Copies of this study (stock number 641-011-00025-4) may be purchased for $7.45 from the Superintendent of Documents, U.S. Government Printing Office (GPO), Washington, D.C. 20402.

1. Energy Conservation

a. Description

Vigorous energy conservation is an alternative that warrants serious consideration. The Project Independence Report of the Federal Energy Administration claims that energy conservation alone can reduce energy demand growth by 0.7 to 1.2 percent depending on the world price of oil. Aside from these savings, it is now widely recognized that wasteful consumption habits impose social costs that can no longer be afforded as do pollution and an inequitable distribution of fuel.

The residential and commercial sectors of the economy are often characterized as inefficient energy consumers. Inadequate insulation, inefficient heating and cooling systems, poorly designed appliances, and excessive lighting are often noticed in these sectors. Reductions in consumption beyond those induced by fuel price increases could be achieved by new standards on products and buildings, and/or subsidies and incentives. Such incentives include standards for improved thermal efficiency in existing homes and offices and minimum thermal standards for new homes and offices.

Excessive consumption is also evident in the industrial sector where energy inefficient work schedules, poorly maintained equipment, use of equipment with extremely low heat transfer efficiencies,

and failure to recycle heat and waste materials are all commonplace. Estimated energy savings of between 10 and 30 percent may be available in this sector of the economy.

Transportation of people and goods accounts for approximately 25 percent of nationwide energy use. Energy inefficiency in the transportation sector varies directly with automobile usage. Automobiles, which account for 90 percent of all passenger movement in the nation, use more than twice as much energy per passenger mile as buses. Moreover, the average car carries only 1.3 passengers. Using short- and mid-term conservation measures such as consumer education, lower speed limits, rate and service improvements on public transit and rail freight transit, energy savings of 15 to 25 percent might be achieved.

Other policies which could encourage fuel conservation in transportation include standards for more efficient new autos and incentives to reduce miles traveled. An important new development in the fuel economy area could be the modification of the standard internal combustion engine. Although such an engine is now in the advanced stages of development, further study by automotive engineers, industry, and concerned federal agencies is necessary before an acceptable engine may be improved.

Significant energy savings are clearly possible through accelerated conservation efforts. The Project Independence Report estimates that conservation alone could result in a 2.2 million barrel per day reduction in petroleum demand by 1985. These savings will be necessary in order to achieve the goals of energy self-sufficiency. In addition, several of the strategies mentioned above have been at least partially implemented by the Energy Policy and Conservattion Act of 1975 (P.L. 94-163).

b. Environmental Impacts

The environmental impacts of a vigorous energy conservation program will be primarily beneficial. The exact nature and magnitude of these impacts will depend on whether there is a net reduction in energy use or whether the reduction is accomplished through technological change and substitutions. For the former, the net impacts will simply be that there are fewer pollutants of all kinds unleashed. As an example, the 2.2 million barrel per day savings by 1985 mentioned above would result in a diminishment nationwide of various pollutants by the following amounts.[1]

CO--4 lbs/1000 gals = 189 tons/day
Hydrocarbons--3 lbs/1000 gals = 142 tons/day
Particulates--23 lbs/1000 gals = 1088 tons/day
$NO_x$--60 lbs/1000 gals = 2838 tons/day
$SO_2$--157 lbs/1000 gals = 7426 tons/day

[1]HUD Contract #H2026R: "Research Evaluation of a System of Natural Air Conditioning."

However, if energy conservation is achieved by technological change or substitution, the net reductions will be those above, less the incremental pollutants from other sources, as well as any new pollutants which might arise from these other sources.

2. Conventional Oil and Gas Supplies

a. Description

Large quantities of oil and gas still remain in the United States. The U.S. Geological Survey estimates that onshore crude oil measured reserves as of December 31, 1974, were about 37 billion barrels, indicated reserves were 4.33 billion barrels, inferred reserves were 20.4 billion barrels, and undiscovered recoverable resources ranged from 37 billion barrels with a 95 percent probability to 81 billion barrels with a 5 percent probability.

Despite the magnitude of reserves, domestic oil production is likely to continue to decline from its peak production rate attained in 1970. All of the twelve oil production forecasts discussed in the Project Independence Blueprint claimed that, in the next few years, the United States petroleum production decline would continue. Most of these same forecasts predict increasing domestic production by the late 1970's, but only under the most favorable conditions in terms of prices, development of OCS resources, regulations, and environmental constraints.

The development of new reserves required to meet gas demand will depend on continued development of onshore areas and of commercially viable nuclear stimulation or massive hydraulic fracturing to produce natural gas from low permeability reservoirs. Additional domestic oil reserves are recoverable through secondary and tertiary extraction techniques. However, the additional oil that is attainable in this manner is in many cases "old" and hence subject to price controls. These controls have diminished the incentive for using these sophisticated and expensive recovery methods.

One study of future natural gas production rates[1] concluded that the upper production limits of natural gas are now being approached. Two constraints are identified: the level of recoverable resources, and the production level that can be sustained for a reasonable time period, Once assumptions of these two levels are made, there is not much room for variations in the maximum potentially attainable production rate. Assuming the current Potential Gas Committee's estimate of recoverable domestic natural gas resources (1845 Tcf for the U.S. including Alaska), the study considers two possible levels of natural gas production: 25 to 30 TCF/year under optimistic conditions, and 20-25 Tcf/year under less optimistic conditions.

A detailed description of the crude oil and natural gas systems is found in Chapters 3 and 4 of Energy Alternatives: A Comparative Analysis.

To substitute directly for the subject sale, a combination of onshore and OCS production from other areas and continued foreign imports would be required to make up for the estimated total production of this proposed sale of 0.4 to 1.4 billion barrels of oil and 2.6 to 9.4 trillion cubic feet of gas, over a 25-year period.

b. Environmental Impact

This substitution would entail environmental impacts such as land subsidence, soil sterilization, and disruption to existing land use patterns. Equipment failure, human error, and blowouts may also

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1 John W. Duane and Michael A. Karnitz, "Domestic Gas Resources and Future Production Rates," Power Engineering (January, 1975), p.36-39.

impair environmental quality. Moreover, poor well construction, particularly in older wells, and oil spills can result in ground and surface water pollution.

The magnitude of these impacts would depend on whether the increased production resulted from improved recovery methods or new discoveries. If improved recovery is realized, the impacts will likely be of little significance and will occur in already developed areas. Should new discoveries be found, and this is unlikely, the impacts will be more significant and disruptive, as the whole new infrastructure would have to be built from the ground up.

The water pollutants from onshore oil production are oil and dissolved solids. The amounts of each vary over a wide range. A summary of this is available in Energy Alternatives: A Comparative Analysis.

Air pollutants (particulates, $NO_x$, $SO_x$, hydrocarbons and CO) result from blowouts and subsequent evaporation and burning. These are generally insignificant, except locally. These effects will be basically the same, whether the production is on or offshore.

Given the fact that onshore supplies are dwindling, the Mid-Altantic States would have to continue their reliance on other regions and foreign imports for needed oil and gas. The decline in these supplies, even with energy conservation, could mean further industrial shutdowns, unemployment rises, higher consumer prices, and changes in standard of living. The lack of natural gas will mean additional use of "dirtier" alternative fuels (oil, coal) with consequent impacts on air quality and human health.

3. Coal

a. Description

Coal is the most abundant energy resource in the United States. Coal deposits underlying nearly 460,000 square miles in 37 States constitute one-quarter of the known world supply and account for 80 percent of our proven fuel reserves. Proved reserves of coal contain 125 times the energy consumed in 1970. A detailed discussion of the coal resource system can be found in Chapter 1 of Energy Alternatives: A Comparative Analysis.

To replace the energy expected to be realized from the proposed Mid-Atlantic sale, 8 to 29 million tons of coal per year would be necessary. Though domestic reserves could easily provide this quantity, serious limitations to coal development exist. In many uses, particularly in the Mid-Atlantic area, coal is an imperfect substitute for oil or natural gas. In many other cases, coal use and production is restricted by government constraints, limited availability of low sulfur deposits, inadequate mining, conversion, and pollution abatement technology, and the hazardous environmental impacts associated with coal extraction and electricity generated from coal. Coal production is also threatened by the unique set of labor problems associated with mining and new strict standards for coal mine safety.

Although U.S. coal resources are very large, as with other extractable mineral fuels, there is some geographic dislocation. Most of our coal is found west of the Mississippi River far from the concentrated industrial areas of the Mid-Atlantic. The Eastern Province contains only nine percent of the total estimated domestic coal resources. However, it contains 80 percent of the remaining identified high-rank bituminous coal. Also, much of the western coal is in arid or semi-arid areas where scarcity of water could constrain development.

The portion of the demonstrated reserve base that is available for use depends on whether the coal deposit can legally be mined, and if it can, whether it is suited for underground or surface mining. Surface mines may recover up to 90 percent of the coal in a given mine; underground mines may recover 50 to 60 percent using room and pillar methods. Both underground and exposed coal deposits are found in the Eastern Province. However, statistics indicate that at the 1972 price only 12 percent of the total resource could be considered economically recoverable. As with other extractable hydrocarbons, the quantity of available coal is a function of coal's market price. Current increases in the market price for coal are making more of this resource base available for domestic consumption.

b. Environmental Impact

Coal Utilization

Combustion of coal results in various emissions, notably $SO^2$ and particulates. If the expected production from this sale is replaced by coal, there will be an increase in these pollutants, especially if coal is substituted for the natural gas presently used. Technology to control these emissions is available but has not yet been proven sufficiently to be widely applied. The sulfur content of eastern coal varies considerably but approximately 65 percent of the developed resources have a sulfur content exceeding one percent. Most of the U.S. low sulfur coal is located in the western states, far from major markets in this Mid-Atlantic area. Any large scale shift to coal would require relaxation of emission regulations or improvement of technologies to convert coal to gaseous or liquid fuels.

Surface Mining

The 8 to 29 million tons per year of coal that would be necessary to replace production from this proposed sale would require up to six large open-pit mines (assuming $5 \times 10^6$ tons annually each). The primary impact of surface mining is disruption of the land. This affects all local flora and fauna, water quality, and increases landscape problems due to erosion and runoff from the mines. Reclamation is difficult in the western states due to the lack of water to assist in revegetation. Other problems include acid mine

water drainage, leachings from spoil piles, processing waste, and the disturbance caused by access and transportation. Noise and vibration resulting from operations can also be expected. Finally, surface mining causes conflicts with other resource uses (agriculture, recreation, water, wildlife habitat, as examples).

The land use of strip-mining ranges from 018 to 5.9 acres /$10^{12}$ Btu extracted, depending on seam thickness and Btu content of the coal. Assuming a ball park figure of two acres/$10^{12}$ Btu, the annual surface disturbance to substitute coal for oil and gas from this proposed lease sale could range from 385 to 1400 acres. Since this disturbance is incremental, the total impact, assuming a 25-year field lief, could be as much as 15 to 56 square miles per year.

Underground Mining

To replace the expected production from this proposed Mid-Atlantic sale, from 4 to 15 underground mines would be required (assuming $2 \times 10^6$ annual tons each). Underground mining primarily affects land and water quality. The land impacts are those that arise from subsidence, waste disposal, and access and transportation. Very little surface is disturbed. Subsidence can destroy structures, cause landslides and earthquakes, and disrupt groundwater circulation patterns. The amount of subsidence can be controlled by the mining method used and the amount of coal removed. Both have detrimental effects on the economics of the operation.

Water quality is affected by both processing waste and the drainage of acid mine-water into surrounding areas. These can be minimized through the proper methods of control both during and after operations. Entrances can be sealed, waste piles can be replaced in the mine. This would also help minimize subsidence. Also, there are pollution problems associated with road and coal dust and the like, but these are minimal and easily controlled. Other disturbing aspects of mining have much less of an impact in an underground than a surface mine. Working conditions of underground mines have been improved under the Federal Coal Mining Health and Safety Act of 1969, although further efforts are needed to reduce health hazards. This program has resulted in increasing costs of underground mining relative to surface mining, which has even more severe environmental restraints and impacts.

Coal Transportation

The five major transportation systems (road, rail, water, conveyor, and pipeline) all have some adverse environmental impacts. These include air and noise pollution, safety, land use, trash, disposal, and aesthetics. However, since spill problems are not associated with coal, most of the impacts can be controlled with greater care and consideration. A slurry pipeline also requires large supplies of water and must adequately dispose of this at the other end. Water availability is a problem in many areas of the U.S., especially in the west where energy resource requirements will have to compete with

other existing commercial and private users for a limited and fragile supply. Construction of such slurry pipelines over long distances to the Mid-Atlantic area from the coal-abundant states would involve extensive costs that may not be economically feasible for many years yet to come.

Coal Conversion

Technology for conversion of coal into gaseous and liquid hydrocarbons has been established for several decades and a number of relatively low-capacity commercial plants exist in various parts of the world. However, few cost-effective advanced technologies have progressed beyond the pilot plant stage.

Numerous problems remain before commercial development of synthetic fuels from coal can proceed. Specific technical problems must be solved. The cost effectiveness of synthetic fuels from coal will depend on prices of other fuels, primarily oil and natural gas.

Control of adverse environmental effects will increase the cost of producing synfuels. Possible constraints on development include technological constraints; availability of skilled workers, raw materials (coal, water, steel), capital; and institutional constraints: government policies (energy resource leasing, coal mining regulations, permit procedures, etc.), and the willingness of industry to invest in development of new technologies.

Synthetic oil and gas could contribute substantially to energy supplies by the year 2000--up to 14 percent according to the Synfuels Interagency Task Force (Report to the President's Energy Resources Council, November 1975). However, the most important contributors would be high-Btu gas from coal, and synthetic crude oil from oil shales. Prospects for coal liquification and low-Btu gas appear less attractive. The success of these energy sources will depend on developing technology, the cost of the impacts, especially coal, and the cost of conventional oil and gas.

Coal Gasification

Gaseous fuels with low, intermediate, or high energy content can be produced. Low and intermediate gases are produced in a two-stage process involving preparation and gasification, and the output is utilized as feedstock for electric generators. A third process, upgrading, is required to produce high-Btu gas, which produces an end product useable by the consumer.

Among low-Btu gasification processes under development are: Lurgi, Koppers-Totzek (both in commercial use), Bureau of Mines Stirred Fixed Bed, and Westinghouse Fluidized Bed. Among high Btu-gasification processes are: Lurgi high-Btu gasification process, HYGAS, BI-Gas, Synthane, and $CO_2$ Acceptor.

The environmental impacts of coal gasification are those of mining plus those resulting from the production processing. Gasification processes have lower primary efficiency than direct coal combustion; more coal will have to be gasified to reach an equivalent Btu output. However, it is likely that coal gasification will achieve primary efficiencies of 70 percent,[1] which is about twice that of coal to electricity end use. Water impacts of processing can be minimized by recycling and evaporation. However, large inputs of water are required for some of the technologies, thus creating the potential for conflicts in water-short areas. For example, a Koppers-Totzek gasifier producing $250 \times 10^9$ Btu per day will require water in the amount of 463,000 gallons per day and coal in the amount of 10,750 tons per day. To substitute for this proposed sale, from two to eight complexes would require from 338 to 1352 million gallons of water per day and 7.7 to 30.9 million tons of coal per year. The land use required for these plants, if they were to be located in the Mid-Atlantic region, based on 330 acres per plant, would be from 660 to nearly 2640 acres, or one to four square miles.

Air pollution could include sulfur dioxide, particulates, nitrous oxides, hydrocarbons, and carbon monoxides.

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[1]Dean Hale, "New Developments, New Problems Highlight Coal Gasification Activity," Pipeline and Gas Journal, March 1, 1975, p. 27.

Land impacts result from solid waste disposal plus the land use for plant, coal storage, cooling sands, etc. Solid wastes include ash, sulfur and minute quantities of some radioactive isotopes.

Coal Liquefaction

As with coal gasification, production of liquid fuels from coal requires either addition of hydrogen or removal of carbon from the compounds in the coal. Coal liquifaction can be viewed as a change in the carbon to hydrogen ratio that can be accomplished by one of these reactions: hydrogenation, pyrolysis, or catalytic conversion. Of these, only the last is in commercial operation. Among liquefaction processes under development are: Synthoil, H-Coal, Solvent Refined Coal, Consol Synthetic Fuel, COED, TOSCOAL, and Fischer-Tropsch.

Again, the impacts of liquefaction will be those of mining and those of the processing plants. The available technologies have a recovery of from 0.5 to 3 barrels of oil per ton of coal processed.

Water effluents from liquefaction plants could contain amounts of phenols, solids, oil, emmonia, phosphates, and others. The waste water could be treated to remove most of these.

Air pollution could result from particulates, nitrogen and sulfur oxides, and other gases. Pollution control facilities would be required, but would lower the economic attractiveness of the plants.

Solid wastes would be mostly ash. Residue could be buried in the mine with little further environmental impact, if liquefaction plants are sited at the mine mouth.

Impacts from this alternative would probably be absorbed by states other than those on the Mid-Atlantic coast (although Maryland and Virginia have some coal resources).

4. Nuclear Power

a. Description

The predominant nuclear system used in the United States is the uranium dioxide fueled, light water moderated and cooled nuclear powerplant. Research and development is being directed toward other types of reactors, notably the breeder reactor and fusion reactors.

As of December 31, 1975, 56 nuclear plants with capacity of 37,500 MW were licensed to operate. At the end of 1975, nuclear power generated about eight percent of the nation's electricity. However, about half of the electric power capacity now under construction is nuclear powered. Nuclear power development has encountered delays in licensing and siting, environmental constraints, and manufacturing and technical problems. Future capacity will be influenced by the availability of plant sites, plant licensing considerations, environmental factors, nuclear

fuel costs, rate of development of the breeder and fusion reactors, and capital costs. In order to meet future uranium fuel requirements, it will be necessary to local additional ore reserves through increased exploratory drilling activity.

Fuel cycle costs of nuclear reactors have increased only slightly since 1965, from a range of about 17 cents to 22 cents per million Btu, to about 30 cents in 1974. Present trends in reactor capital costs are significantly narrowing the economic advantage offered by fuel cycle costs, over coal and oil-fired plants.

b. Environmental Impact

Although nuclear plants do not emit particulates or gaseous pollutants from combustion, the potential for serious environmental problems exists. Some airborne and liquid radioactive materials are relased to the environment during normal operation. The amounts released are very small and potential exposure has been shown to be less than the average level of natural radiation exposure. The plants are designed and operated in such a way that the probability of harmful radioactivity released from accidents is very low.

Nuclear plants use essentially the same cooling process as fossil-fuel plants and thus share the problem of heat dissipation from cooling water. However, light water reactors require larger amounts of cooling water and discharge greater amounts of waste

of cooling water and discharge greater amounts of waste heat to the water than comparably sized fossil-fuel plants. The effects of thermal discharges may be beneficial in some cases. Adverse effects can be mitigated by use of cooling ponds or cooling towers.

Low level radioactive wastes from normal operation of a nuclear plant must be collected, placed in protective containers, and shipped to a Federally-licensed storage site and buried. High level wastes created within the fuel elements remain there until the fuel element is processed. Currently, spent fuel is stored at NRC-licensed facilities. Plans call for recovering unused fuels at reprocessing plants, solidifying the wastes, and placing them in storage at a Federal Repository.

Primary residuals from light water reactors are waste heat and radioactive emissions. For a 1000 MW(e) plant operating at a 75 percent load factor, a 33 percent efficient nuclear plant would emit $47 \times 10^{12}$ Btu's of waste heat annually. For comparison, a 40 percent efficient fossil fuel plant would emit $36 \times 10^{12}$ Btu's of waste heat.

To substitute for this Mid-Atlantic proposed sale, it would take from 3 to 11 1000 MW(e) light water reactors to supply the equivalent energy, assuming 33 percent plant efficiency and 80 percent loading. First core loading of these plants would require from 90 to 330 metric

tons of enriched uranium ($U_3O_8$), with annual reloadings requiring from 30 to 110 metric tons total. This kind of substitution assumes that all oil and gas produced from this sale would generate electricity. Nationally, only eight percent of oil and 18 percent of gas consumed is utilized to generate energy. Thus, due to the economic infrastructure of the Mid-Atlantic region, especially the vast petrochemical-related industries, nuclear power would not be able to provide a substitute for significant sectors of the economy.

Additionally, there are the impacts on land, water, and air quality arising from the mining of these uranium ores. Dwindling amounts of high grade reserves will increase the amounts of land mined for lower grade radioactive ores--primarily in western states. The mining operations will be similar to coal, but the nature and distribution of the deposits means "lesser" impact; radioactive tailings cause unusual problems for disposal, the environment, and human health.

A more complete discussion of uranium mining and processing, their economics and environmental impacts, and nuclear fission and fusion can be found in Chapters 6 and 7 of Energy Alternatives: A Comparative Analysis.

5. Oil Shale

a. Description

Large areas of the United States are known to contain oil shale deposits but those in the Green River formation in Colorado, Wyoming, and Utah, have the greatest commercial potential.

The oil shale resources of the Green River formation are estimated at 1781 billion barrels, of which 129 billion barrels are classes one and two resources, 186 billion barrels are class three resources, and 1466 billion barrels are class four resources.[1]

To substitute the energy equivalent estimated to be produced from this proposed Mid-Atlantic sale, from 1.25 to 4.43 billion tons of oil shale would have to be mined and processed, i.e., from 137,000 to 485,000 tons per day.

b. Environmental Impact

Oil shale development poses serious environmental problems. With surface or conventional underground mining, it is very difficult to dispose of the huge quantities

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[1]U.S. Energy Outlook, National Petroleum Council, Washington, D.C., 1972, pp. 207-208. Classes one and two deposits are at least 30 feet thick and average 30 gallons of oil per ton of shale, and include only the most accessible and better defined deposits. Class three deposits are as rich as classes one and two but more poorly defined and less favorably located. Class four deposits are lower grade, poorly defined deposits ranging down to 15 gallons of oil per tone of shale.

of spent shale, which occupy a larger volume than before the oil was extracted. Inducing revegetation in an area of oil shale development is difficult and may take more than ten years. In-place processing avoids many of these environmental hazards. The spent shale problem is much less severe with underground mining.

Air pollutants from the mining will come from dust and vehicular traffic. These will be predominantly particulates, followed by $NO_x$ and CO, with minimal amounts of hydrocarbons $SO_x$, and aldehyde.

The mining of oil shale requires little water, both for operations and for reclaiming solid wastes. Water pollutants are considered negligible but may arise if saline water were encountered during the operations and had to be disposed of.

However, the processing (retorting) operations consume large quantities of water and generate large amounts of waste water. The waste water must be treated and can be reused in the processes. Therefore, it has been assumed that water pollution will not be a problem outside the complex. However, the limited availability of input water in the development area could lead to resource use conflicts.

Air pollutants vary with the technology used. Solid waste comprises the greatest problem of oil shale processing. The volume of the waste is greater than the volume of the input. Therefore, backfilling and the like would not provide a sufficient disposal space. Finally, there are the impacts of access and of transporting the products. These are analogous to those of coal mining in the case of access, and petroleum distribution in the case of transporting the product.

A fuller description of this energy source can be found in Chapter 2 of Energy Alternatives: A Comparative Analysis.

6. Hydroelectric Power

a. Description

Hydropower is energy from falling water, which is used to drive turbines and thus produce electricity. Conventional hydroelectric developments convert the energy of natural regulated stream flows falling from a height to produce electric power. Pumped storage projects generate electric power by releasing water from an upper to a lower storage pool and then pumping the water back to the upper pool for repeated use. A pumped storage project consumes more energy than it generates but converts offpeak, low value energy to high value peak energy. A more detailed discussion of this energy source is found in Chapter 9 of the study Energy Alternatives: A Comparative Analysis.

Many of the major hydroelectric sites operating today were developed in the early 1950's. Thirty to forty years ago hydroelectric plants supplied as much as 30 percent of the electricity produced in the United States. Although hydroplant production has steadily increased, thermal-electric plant production has increased at a faster rate.

As of May 1974, total conventional hydropower developed in the contiguous United States was 54,885 MW, nearly one half of which was in the western states of Washington, Oregon, and California. Some 6878 MW of conventional hydro capacity are now being installed, about 90 percent of which is in the western part of the country.

Much of recent hydroelectric development has been pumped storage capacity. As of May 1974, the total developed pumped storage capacity in the contiguous United States was 8119 MW; capacity under construction was 6253 MW. Over 30 percent of both developed capacity and capacity under construction is in the Mid-Atlantic region.

The undeveloped potential for hydroelectric generation is about 93,000 MW in the lower 48 states and about 32,000 MW in Alaska. However, it is likely that hydroelectric power will continue to represent a declining percentage of the total U.S. energy mix due to the following: high capital costs, seasonal variations in

waterflows, land use conflicts, environmental effects, water use, and flood control constraints. Sites with the greatest production capacity and lowest development costs have already been exploited.

b. Environmental Impact

Construction of a hydroelectric dam represents an irreversible commitment of the land resource beneath the dam and lake. Flooding eliminates wildlife habitat and prevents other uses such as agriculture, mining, and free-flowing river recreation.

Hydroelectric projects do not consume fuel and do not cause air pollution. However, use of streams for power may displace recreational and other uses. Water released from reservoirs during summer months may change ambient water temperatures and lower the oxygen content of the river downstream, adversely affecting indigenous fish. Fluctuating reservoir releases during peak load operation may also adversely affect fisheries and downstream recreation. Screens placed over turbines prevent the entrance of fish, but small organisms may pass through and may be killed.

Fish may die from nitrogen supersaturation, which results at a dam when excess water escapes from the draining reservoir. High nitrogen levels in the Columbia and Snake Rivers pose a threat to the salmon and steelhead resources of these rivers. Other adverse impacts to water quality include possible saline water intrusion into waterways and decreased ability of the waters to accommodate waste discharges.

Air quality will only be affected by dust and emissions during the construction phase. Afterwards, if the impoundment is used for recreation, motor exhausts would occur.

Land, other than that inundated, would be disturbed by support facilities, roads and transmission line rights-of-way.

7. Solar Energy

a. Description

Applications of solar energy must take into account the following:

- Solar energy is a diffuse, low intensity source.
- Its intensity is continuously variable with time of day, weather, and season.
- Its availability differs widely between geographic areas.

Potential applications of solar energy show a wide range. Among them are:

- Thermal energy for buildings

  Water heating, space heating, space cooling, combined systems

- Renewable clean fuel sources

  Combustion of organic matter

  Bioconversion of organic materials to methane

  Pyrolysis of organic materials to gas, liquid, and solid fuels

  Chemical reduction of organic materials to oil

- Electric power generation

  Thermal conversion

  Photovoltaic - residential/commercial, ground central station, space central station

  Wind energy conversion

  Ocean thermal difference

Because of the energy situation, Congressional interest in solar energy research has intensified. The Solar Heating and Cooling Demonstration Act of 1974 legislates a $60 million demonstration program aimed at proving the commercial feasibility of solar heating of buildings and homes by 1977 and of combined solar heating and cooling systems for those structures by 1979. A recent project in the Southwest U.S. has been approved for experiment by the Energy Research and Development Administration. Interest in this

energy source in the Mid-Atlantic region has intensified in the past couple of years with the increase in conventional space heating fuel costs, however, only a few individual efforts have been developed to-date.

b. Impacts

Although fuel costs for backup systems and maintenance costs for solar units are small when compared with operating costs of conventional heating and cooling systems, the high initial or "fixed" costs of solar units make them unattractive to many homeowners and builders. The typical solar heating system for a home costs $5,000-$6,000 (including costs of a standby conventional furnace) compared to $1,000-$2,000 for a conventional fossil-fuel home heating unit. However, the rising cost of the gas and oil needed by the conventional heaters means that, over time, the greater fixed costs of solar systems will be balanced by their lack of fuel costs.

Large-scale generation of electricity using solar energy is another promising application which is receiving increased funding. The Ford Administration has requested $33 million for solar electric programs in fiscal 1975--almost $26 million more than the fiscal 1974 appropriation. A number of technical and engineering problems now prevent commercialization of solar steam-electric plants, though pilot projects are well underway. It is estimated that solar electricity will be available on a significant scale in 10 to 15 years or more.

Among the disadvantages of solar-electric energy are high capital costs, expensive maintenance of solar collectors, thermal waste disposal, and distortion of local thermal balances.

c. Environmental Impact

The impacts so far identified with solar energy are relatively minimal. The primary effects of the use of this energy source on a wide scale will be land use. Due to the low density of the energy, large areas will be necessary for the collectors. However, the land use compares favorably with other forms of energy use such as coal extraction.

The only other area for concern known so far is thermal pollution. Direct use in space heating has no thermal effects. However, for solar electric power generation, heat will have to be collected and transferred to the generator. Some localized thermal pollution may occur as a result, but the problem is not expected to be significant. Finally, solar plants can only operate intermittently, especially in the Mid-Atlantic States where hours of sunshine and solar energy concentration are lower than for other regions (particularly the southwest). Thus, the energy will have to be either stored, or backup fossil-fuel plants will have to be built. These will have their own sets of environmental constraints.

Additional detail on this resource alternative is found in Chapter 11 of Energy Alternatives: A Comparative Analysis.

8. Oil Imports

a. Description

U.S. reliance on imported oil has increased steadily in the last decade. The increased tonnages of foreign crude entering the Mid-Atlantic ports from 1950 to 1973, as discussed in Section II.G.1., indicates this trend succinctly. Competition on the world market and recent cutbacks in Middle Eastern oil exports (oil embargo of 1973) have raised concerns about availability of oil imports in the future. Declining resource availability and increasing domestic demand restrict potential imports from the Western Hemisphere nations, particularly Venezuela and Canada. Increasing imports from the Middle East brings problems of stability of supply, balance of payments, and U.S. off-loading capacity.

In January 1975, U.S. imports of petroleum and petroleum products were 212,035,000 barrels at a total cost of $3.3 billion. Average cost per barrel was $11.58. After imposition of the import tariff, imports fell in February 1975 to 172,931,000 barrels at a total cost of $1.8 billion. Average cost per barrel was $11.63. This was the lowest import level since March 1974, when the cost of imports was $1.77 billion.

During the latest month for which statistics are available, October 1975, total U.S. imports of petroleum and petroleum products were 195 million barrels; of this amount, 86.3 million barrels were imported to Petroleum Administration District I (East Coast), 44 percent in the form of crude oil (Bureau of Mines statistics). Consumption for October 1975 was reported by FEA at 525 million barrels for the U.S. as a whole. This compares to consumption of 557 and 478 million barrels for January and February 1975, respectively.

b. Environmental Impact

The primary hazard to the natural environment of increased oil impoarts is the possibility of oil spills, which can result from accidental discharge, intentional discharge, and tanker casualties. Intentional discharges would result largely from tank cleaning operations. The effects of chronic low-level pollution are largely unknown. The worldwide tanker casualty analysis indicates that, overall, an insignificant amount of the total volume of transported oil is spilled due to tanker accidents. However, a single incident such as the breakup of the Torrey Canyon can have disastrous results. With increasing tanker traffic in already busy harbors, the probability of such an incident is increased.

Of more concern though is the impact to the social and economic environment. The potential for a future embargo under this option is such that American productivity and policy could become subserviant to foreign influence. Particularly sensitive would be the Mid-Atlantic States oil and gas supply which already is heavily dependent on foreign energy sources at the present time. Prices, products, and employment in the region may fluctuate, and fluctuate severely, because of international decisions beyond the control of Mid-Atlantic States. On a more subtle level, political alignments and policies of the United States could become tied to those of foreign oil powers. This option is the least acceptable for continued American energy independence.

9. Natural Gas Imports

a. Description

Imports of natural gas via pipeline have come largely from Canada, with small amounts from Mexico. In 1973, net pipeline imports from Canada were 1,028 Bcf, about 4.6 percent of total natural gas used in the United States. These imports were about 33 percent of Canada's natural gas production. Natural gas pipeline imports from Mexico have not been a significant part of U.S. supply. In 1973, imports from Mexico were 1.6 Bcf.

Mexico is not likely to be a significant source of future imports because of its relatively small natural gas resource base, its policy of self-sufficiency in energy, and the small volume of current U.S. imports from Mexico. Imports from Mexico were of a local natural until 1957 and have declined since 1969. Canadian intentions to gradually phase out oil exports to the U.S. also puts into question increased natural gas pipeline exports.

Natural gas imports would have to be about 0.5 to 3.0 billion cubic feet per day to replace the gas production estimated to be available from this proposed Mid-Atlantic sale.

b. Environmental Impact

The environmental impacts of increasing gas imports derive mainly from the possible increased use of land for pipeline construction. A further impact is the risk of explosions and fires. As with imports of oil, the Mid-Atlantic States could become dependent on foreign control of supply. Fluctuations of that supply could influence quality of life, productivity, and employment. American policies could also become influenced by decisions of foreign oil powers, much as they could under the option of increasing oil imports.

10. Liquefied Natural Gas Imports

a. Description

The growing shortage of domestic natural gas has encouraged projects to import liquefied natural gas (LNG) under long-term contract. Large scale shipping of LNG is a relatively new industry. Several LNG projects are now under consideration on the Pacific, Atlantic, and Gulf coasts. One such project is currently under construction at Cove Point in Calvert County, Maryland in the Chesapeake Bay. Security of foreign LNG is questionable. The complexity of and length of time involved in implementing these proposals has been increased by the need for negotiating preliminary contracts, securing the approval of the Federal Power Commission and the exporting country, and making adequate provision for environmental and safety concerns in the proposed U.S. facilities.

b. Environmental Impact

The environmental impacts of LNG imports arise from tankers; terminal, transfer, and regasification facilities; and transportation of gas. The primary hazard of handling LNG is the possibility of a fire or explosion during transportation, transfer, or storage.

Receiving and regasification facilities will require prime shoreline locations and dredging of channels. Regasification of LNG will release few pollutants to the air or water.

LNG imports will influence the U.S. balance of payments. This impact will depend on the origin and purchase price of the LNG, the source of the capital, and the country (U.S. or foreign) in which equipment is purchased and LNG tankers are built.

11. Geothermal Energy

a. Description

Geothermal energy is primarily heat energy from the interior of the earth. It may be generated by radioactive decay of elements such as uranium or thorium, and friction due to tidal or crustal plate motions.

There are four major types of geothermal systems: hot water, vapor dominated, geopressured reservoirs, and hot dry rock systems.

In addition to electricity, geothermal energy can offer a potential for space heating, industrial processing, and other nonelectric uses in many areas which presently are highly dependent upon oil and gas for energy needs. However, geothermal electric generating plants are smaller than conventional plants and require a greater amount of steam to generate the same amount of energy. This is due to the fact that temperatures and pressures associated with geothermal areas are lower than those created at conventional power plants. In some areas, geothermal resources may have potential for space heating, industrial processing, and other non-electric uses.

The greatest potential for geothermal energy in the U.S. is found in the Rocky Mountain and Pacific regions; some potential exists in the Gulf Coastal Plain of Texas and Louisiana. The Geysers field in California is the most extensively developed source of geothermal energy in the United States. It has been producing power since 1969. Exploration efforts are also underway in the Imperial Valley, Salton Sea, Mono Lake, and Modoc County, California.

Within 20 years, geothermal energy may account for about 1 to 2 percent of total U.S. energy and about 5 percent of California's total energy consumption.

However, this energy source is not thought to be beneficial to the energy needs of the Mid-Atlantic area. Large resources of this type are not known to be located in sites in close proximity to the East Coast States that would benefit from oil and gas resources that are anticipated from this proposed sale.

b. Environmental Impact

A number of gases are associated with geothermal systems and may pose health and pollution problems. These gases include ammonia, boric acid, carbon dioxide, carbon monoxide, hydrogen sulfide, and others. However, adverse air quality impacts are generally less than those associated with fossil-fuel plants. Also associated with geothermal energy systems are saline waters which must be disposed of and isolated from contact with ground water regimes.

Land quality problems stem from disturbance due to construction of related facilities, and possible ground subsidence which, in turn, can cause structural failures and loss of ground water storage capacity.

12. Other Energy Sources

The high cost and rapidly shrinking reserves of the traditional energy fuels have encouraged research into new and different sources for potential energy. Some of these alternate sources have been known for decades but high costs and technical problems have prevented their widespread use. They include tidal power, wind power, organic fuels and ocean thermal-gradients among others.

Environmental impacts of these alternatives are difficult to assess, especially as a great amount of research and development remains to be completed before operational scale systems can be developed, tested, and evaluated for production and application.

The date of commercial availability of such alternatives will depend on the cost of the traditional energy fuels, the level of Federally subsidized research through ERDA assistance, and the solution of engineering and technical problems.

13. Combination of Alternatives

Within the Mid-Atlantic region a combination of some of the most viable energy sources available to this area, discussed

above, could be utilized to attain an energy equivalent comparable to that estimated to be produced within the 25-year field life anticipated by this proposed action. However, this combination of alternatives, in order to attain the needed energy mix peculiar to the infrastructure of this area, would have to consist of energy sources attainable now or within the 25-year timeframe that are transferable to the technology presently used, i.e., viable substitutes would have to be available for the petroleum and natural gas required by the petrochemical industrial complex, the petroleum used for the transportation sector, and the electricity and fuels used in the Mid-Atlantic residential and commercial sectors.

Part II of the Energy Alternatives: A Comparative Analysis, particularly Chapter 16 "Comparing the Economic Costs of Energy Alternatives," discusses the factors that must be involved in developing technically and economically appropriate energy alternatives.

The most viable domestically available energy alternatives for the Mid-Atlantic region, technologies and economies allowing, probably would consist of the use of coal (for use in coal-fired power plants), coal gasification plants (to provide synthetic natural gas), nuclear power and solar energy (to provide energy for space heating), and oil shale processing (to provide petroleum), in addition to conventional

oil and gas resources. The environmental impacts of each of these alternatives has been discussed briefly in the previous sections.

Based upon the range of undiscovered recoverable resources estimated by the USGS for this proposed Mid-Atlantic sale area, Table VIII.C-1 presents the energy equivalents which would be required of other energy sources to substitute for this proposed action.

The future U.S. energy source mix will depend on a multiplicity of factors, among them the identification of resources, research and development efforts, development of technology, rate of economic growth, the economic climate, changes in life-style and priorities, capital investment decisions, energy prices, world oil prices, environmental quality priorities, government policies, and availability of imports.

The Project Independence Report[1] estimated U.S. energy demand and domestic supply for four cases. These data are shown below.

U.S. Energy Demand and Domestic Supply, 1985

| World Oil Price | $11 per barrel | |
|---|---|---|
| | Demand (quads) | Domestic Supply (quads)* |
| Base case w/ and w/o emergency programs | 102.9 | 96.3 |
| Accelerated supply | 104.2 | 104.2 |
| Conservation | 94.2 | 91.8 |
| Accelerated supply plus conservation | 96.3 | 96.3 |

*Quad - a quadrillion Btu's.

[1]The data cited in this section are taken from: Federal Energy Administration, Project Independence Report, November 1974. A more report, The National Energy Outlook, by FEA updates this material.

Table VIII-1. ENERGY NEEDED FROM OTHER SOURCES TO REPLACE ANTICIPATED OIL AND GAS PRODUCTION FROM PROPOSED MID-ATLANTIC OCS SALE NO. 40

| | Range | |
|---|---|---|
| | Low | High |
| Total Crude Oil Production 25-year field life (barrels) | 0.4 billion | 1.4 billion |
| Total Natural Gas Production 25-year field life (cubic feet) | 2.6 trillion | 9.4 trillion |
| Crude Oil Btu Equivalent[1] | $2.24 \times 10^{15}$ | $7.84 \times 10^{15}$ |
| Natural Gas Btu Equivalent[2] | $2.65 \times 10^{15}$ | $9.59 \times 10^{15}$ |
| Total Oil & Gas Btu Equivalent | $4.89 \times 10^{15}$ | $17.43 \times 10^{15}$ |
| Energy Alternative Source Equivalents | | |
| • Oil alone (barrels) | | |
| Total field life | $0.87 \times 10^{9}$ | $3.1 \times 10^{9}$ |
| Annual average | $34.9 \times 10^{6}$ | $124 \times 10^{6}$ |
| Daily average | 95,700 | 339,700 |
| • Gas alone (cubic feet) | | |
| Total field life | $4.8 \times 10^{12}$ | $17.1 \times 10^{12}$ |
| Annual average | $191.5 \times 10^{9}$ | $682.8 \times 10^{9}$ |
| Daily average | $0.5 \times 10^{9}$ | $1.9 \times 10^{9}$ |
| • Coal (tons) | | |
| Total valume[3] | $204 \times 10^{6}$ | $717 \times 10^{6}$ |
| Annual average | $8 \times 10^{6}$ | $29 \times 10^{6}$ |
| Daily average | 22,000 | 79,000 |
| • Coal gasification | | |
| Low Btu[4] | | |
| Number of plants | 2 | 8 |
| Coal required (tons) | | |
| Total volume | $193 \times 10^{6}$ | $771.6 \times 10^{6}$ |
| Annual average | $7.7 \times 10^{6}$ | $30.9 \times 10^{6}$ |
| Daily average | 21,140 | 84,560 |

[1]Assuming one barrel of oil equals $5.6 \times 10^{6}$ Btu.

[2]Assuming one cubic foot of natural gas equals 1021 Btu.

[2]Assuming one ton of coal equals $24 \times 10^{6}$ Btu.

[4]Assuming Koppers-Totzek processing requiring 10,570 tons/day of coal for an output of $250 \times 10^{9}$ Btu's/day. Also assumes coal of 8,780 Btu's per pound.

Table VIII-1. Continued

| | Range | |
|---|---|---|
| | Low | High |
| High Btu[1] | | |
| Number of plants | 2 | 8 |
| Coal required (tons) | | |
| Total volume | 430 x $10^6$ | 1.7 x $10^9$ |
| Annual average | 17.2 x $10^6$ | 68.9 x $10^6$ |
| Daily average | 47,200 | 188,888 |
| • Oil shale[2] | | |
| Total volume | 1.25 x $10^9$ | 4.43 x $10^9$ |
| Annual average | 50 x $10^6$ | 177 x $10^6$ |
| Daily average | 137,000 | 485,000 |
| • Nuclear capacity[3] | | |
| Number of light water reactors (1000 MW(e) capacity) | 3 | 11 |
| First core fuel $U_3O_8$[4] | 90 tons | 330 tons |
| Annual reload | 30 tons | 110 tons |

[1]Assuming Lurgi High-Btu Gasification, requiring 23,600 tons/day of coal for an output of 250 x $10^6$ cf/day of gas. Also assumes coal of 8780 Btu's per pound.

[2]Assuming high grade shale recovery of 0.7 barrels per ton of oil shale.

[3]One kilowatt-hour equals 3412 Btu at theoretical conversion rate of other energy forms to electricity at 100% efficiency. Capacity is calculated assuming an 80% plant factor and 33% efficiency of fossil fuel electricity generation.

[4]Assuming 30 metric tons enriched $U_3O_8$ first core fuels, and 10 metric tons enriched $U_3O_8$ annual reloads with plutonium recycle for each normalized 1000 MW(e) light water reactor.

The table below shows the breakdown of total domestic fuel supplies for the base case and the accelerated supply case.

Table VIII- 2.

Domestic Fuel Consumption by Source, 1985
(in quads)

| | 1972 Actual | $11 world oil Base Case | $11 world oil Acc Supply |
|---|---|---|---|
| Coal | 12.5 | 22.9 | 20.7 |
| Oil | 22.4 | 31.3 | 38.0 |
| Gas | 22.1 | 24.8 | 25.5 |
| Hydro and Geo - thermal | 2.9 | 4.8 | 4.8 |
| Nuclear | 0.6 | 12.5 | 14.7 |
| Synthetics | | | 0.4 |
| Imports | 11.7 | 6.5 | 0 |
| Total | 72.1 | 102.9 | 104.2 |

The increases in domestic supply under the accelerated supply case are due largely to the following:

Standardization and expedited licensing to increase nuclear capacity 15% by 1985.

Significant new leasing, exploration and development of the Pacific, Gulf of Alaska, and Atlantic OCS.

Additional oil and gas pipelines from Alaska to the lower 48 States.

Increased Federal leasing and actions to allow additional oil shale production.

Opening Naval Petroleum Reserves #1 and #4 to full scale commercial development.

Possible mandatory allocation or other actions to assure critical materials and equipment to meet expected production levels.

For the base case, the Project Independence Report envisions the role of alternative energy sources as the following:

> Petroleum production is severely constrained in the short run and greatly affected by world oil prices in the long run. Before 1977 there is little that can prevent domestic production from declining or at best remaining constant.
>
> Coal production will increase significantly, but is limited by lack of markets. Increases are limited by rate of electric growth, increasing nuclear capacity, and environmental restrictions.
>
> Potential increases in natural gas production are limited.
>
> Nuclear power is expected to grow from 4.5% to 30% of total electric power generation.
>
> Synthetic fuels will not play a major role between now and 1985.
>
> Shale oil could reach 250,000 B/D by 1985 at $11 world oil prices, but would be lower if $7 prices prevail.
>
> Geothermal, solar, and other advanced technologies are large potential sources, but will not contribute to our energy supplies until after 1985.

In the interest of clarity of presentation, the early parts of this section have discussed separately each potential alternative form of energy as a possible substitute to the proposed sale. However, it is unlikely that there will ever be a single definitive choice between energy sources, or that development of one source will preclude development of others. Different energy sources will differ in their rate of development and the extent of their contribution to total U.S. energy supplies. Understanding of the extent to which they may

replace or complement offshore oil and gas requires reference to the total national energy picture. Relevant factors are:

- Historical relationships indicate that energy requirements will grow at approximately the same rate as gross national product.
- Energy requirements can be constrained to some degree through the price mechanisms in a free market or by more direct constraints. One important type of direct constraint operating to reduce energy requirements is through the substitution of capital investment in lieu of energy; e.g., insulation to save fuel. Other potentials for lower energy use have more far-reaching impacts and may be long range in their implementation--they include rationing, altered transportation modes, and major changes in living conditions and life styles. Even severe constraints on energy use can be expected to only slow, not halt, the growth in energy requirements within the timeframe of this statement.
- Energy sources are not completely interchangeable. Solid fuels cannot be used directly in internal combustion engines for example. Fuel conversion potentials are severely limited in the short term although somewhat greater flexibility exists in the longer run and generally involves choices in energy-consuming capital goods.

The principal competitive interface between fuels is in electric powerplants. Moreover, the full range of flexibility in energy use is limited by environmental considerations.

- A broad spectrum of research and development is being directed to energy conversion--more efficient nuclear reactors, coal gasification and liquefaction, liquified natural gas (LNG), and shale retorting, among others. Several of these should assume important roles in supplying future energy requirements, though their future competitive relationship is not yet predictable.

- Major potential for filling the supply/demand imbalance for domestic resources are:
  - More efficient use of energy
  - Environmentally acceptable systems which will permit production and use of larger volumes of domestic coals.
  - Accelerated exploration and development of all domestic oil and gas resources.
  - Development of the Nation's oil shale resources.

Of the foregoing, increased domestic oil and gas production offers considerable possibilities, although adequate incentives

must exist for indicated and undiscovered domestic resources to be discovered and extracted.

- The acceptability of oil and gas imports as an alternative is diminished by:
  - The security risks inherent in placing reliance for essential energy supplies on sources which have demonstrated themselves to be politically unstable and prone to use interruption of petroleum supplies to exert economic and political pressure on their customers.
  - The aggravation of unfavorable international trade and payments balances which would accompany substantial increases in oil and gas imports.
  - Apparent high costs of liquefying and transporting natural gas other than overland by pipeline.

D. Alternative OCS Leasing Areas

The following section contains references to the description and impact-producing discussion found in the Final EIS for the proposed program to accelerate OCS leasing nationwide (Programmatic EIS) for each of the various OCS areas of the United States which could support future oil and gas leasing. The timing and extent of potential OCS offshore development in these areas is a function of many factors. Among these considerations are offshore resource potential, environmental and legal constraints, industry capability in developing the required OCS technology and meeting material and manpower needs, and the ability of onshore geographic areas to cope with increased industrial development of the particular adjacent coastal zone.

A proposed planning schedule of leasing areas for proposed OCS oil and gas lease sales was announced to the public in November 1974 and was developed after careful weighing of a number of resource, environmental, and technical factors. This schedule was revised in June 1975 to reflect changes in the timetables for considering certain sales listed on that schedule (see Figure I- 3 ). It is the proposed policy of the Department of the Interior to consider leasing the most promising areas for OCS oil and gas potential first, to the extent that the Department determines that environmental and technical considerations do not warrant delay in considering potential leasing of particular areas of promise.

This approach has been adopted by the Department in light of the contribution that can be made by OCS oil and gas production in meeting domestic energy demand and is designed to ensure that relatively scarce capital, manpower, and equipment resources can be first employed on the most promising areas consistent with the protection of environmental values. The proposed schedule is a flexible planning document and does not represent a decision to lease in any of the particular areas identified therein.

Offshore oil and gas development causes certain common environmental impacts regardless of geographic location. Primary offshore impacts are related to accidental spills of oil and other toxic substances, discharge of drilling fluids and formation waters, pipeline burial, and OCS use conflicts. Onshore impacts result from the siting of processing and support facilities, socioeconomic impacts of increased industrial activity and the potential beaching of spilled oil. In addition, other impacts can be predicted due to special environmental conditions that exist in a specific OCS area. Each of these unique impacts is discussed in detail under the appropriate impact section of the OCS Programmatic EIS as listed below. Also refer to Section III.H. of the Programmatic EIS for a Resources Summary and Oil Spill Risk Summary for each of the considered 17 OCS areas.

1. Atlantic Region

Description of the Environment - Volume 1, Sections II.A.1., II.B.1., and II.C.1-3.

Environmental Impacts - Volume 2, Sections III.C.,E., F. and G.

(Also this EIS for the Mid-Atlantic, Sale #40)

2. Gulf of Mexico Region

Description of the Environment - Volume 1, Sections II.A.2., II.B.2. and II.C.4-5.

Environmental Impacts - Volume 2, Sections III.C.,E., F. and G.

(Also see FES for Sale #41)

3. Pacific Region

Description of the Environment - Volume 1, Section II.A.3., II.B.3. and II.C.6-9.

Environmental Impacts - Volume 2, Sections II.C.,E., F. and G.

(Also see FES for Sale #35)

4. Alaska Region

Description of the Environment - Volume 1, Sections II.A.4., II.B.4. and II.C.10-15.

Environmental Impacts - Volume 2, Sections III.C., E., F. and G.

(Also see FES for Gulf of Alaska, Sale #39)

A discussion of unavoidable adverse environmental affects for each area is found in Section V of the OCS Programmatic Final EIS.

## E. Alternatives Within the Proposed Action

### 1. Government Exploratory Drilling Prior to Leasing

Exploratory drilling conducted by or sponsored by the Federal Government prior to holding a lease sale would be an alternative within the proposed action. This would involve an alternative approach to one aspect of the present Federal leasing system. At the present time there is little exploratory drilling on the OCS prior to leasing. The U.S. Geological Survey receives all engineering and geological data from companies which have drilled on leases issued on the OCS. These data and geophysical data, purchased on the open market, are used by the Geological Survey to develop OCS lease policies and evaluate tracts prior to leasing.

By conducting such an exploratory program, the Government would obtain valuable data on stratigraphy and structure of the potential leasing areas. It would also have more detailed information with which to base resource estimates and evaluate tracts (and their monetary value) before leasing. In addition, coastal states might be able to obtain a better concept of expected development onshore.

To properly evaluate the range of potential hydrocarbon traps in the Mid-Atlantic, upwards of 60 or more exploratory wells might be required.[1] The magnitude of such a program would put a strain on personnel, procedures for contracting and hiring, and the Federal budget (especially at $4-$7 million per well). This procedure could delay leasing for several years just to evaluate the data, further increasing Mid-Atlantic

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[1] R.H. Bowerman, Southern Connecticut Gas Company, stated that exploration staff of the Associated Gas Distributors estimates 50 to 75 wells might be needed (oral testimony, public hearing, DES for proposed OCS lease sale #40, 1976).

reliance on foreign supplies of oil and gas during that period. One decided benefit would be the Federal Government's increased capability to evaluate tracts. However, under this system the Government takes much of the discovery risk. If the Destin Dome offshore Florida had first been explored by the Federal Government with no discoveries; around $1 billion dollars of bonus bids might never have been generated for the U.S. Treasury as a result of the MAFLA sale. On the other hand, if the Federal Government should be responsible for exploration, due to manpower and budget constraints, it would be possible that some less remote though promising areas would not be explored, in favor of other more obvious prospective areas. The Alaskan North Slope area, for example, was explored for several years before any discoveries were found. It is possible as well that oil and gas resources may yet be found at Destin Dome.

2. State Participation in Development Decisions

On November 4, 1975, the Department of the Interior issued a new regulation which assumes greater opportunity for State participation in decisions pertaining to the development of OCS leases. The new regulation is a modification of 30 CFR 250.34. It appeared in 40 Federal Register 51199-51200 and is attached to the FES as Appendix 12.

Previously, 30 CFR 250.34 required that, before a lessee commenced a development program, he must obtain approval of a development plan. This requirement has been expanded in the new regulation so that before the Supervisor acts on a development plan, the Governors of directly affected States shall be given 60 days to review and comment on the plan.

In order to allow a State the opportunity to assess the development plan thoroughly, lessees must provide the Governor with supplementary information at least 30 days before they deliver the actual development plans to the Governor. Such information shall include a description of all proposed offshore and onshore facilities and operations, including location, size, requirements for land, labor, materials and energy, and timing of development and operation, and other related information that may be required by the USGS Supervisor. A Governor has 30 days after the final delivery of this supplementary information within which to notify the Supervisor whether the information

meets the requirements of the regulation. If the Governor notifies the Supervisor that it does not, the Director of the Geological Survey shall review the information and either order the lessee to submit additional information or determine that the information meets the requirements of the regulation. If the Director determines the latter, the 60-day period within which the Governor has to review the development plan shall begin.

A Governor of a directly affected State will therefore have a minimum of 60 days within which to review and comment on a development plan. This period does not include the period of at least 30 days he has to acquaint himself with the supplementary information and additional time he may have because of delays before the 60-day period begins.

In drafting these new regulations, the Department considered both shorter and longer period of time for State review of development plans and the effect of delays in potential lease development that might result from longer review periods. The Department always has the option to amend the regulations if the procedures for State participation in reviewing development plans are found to be inadequate.

An alternative to the new 30 CFR 250.34 available to the Secretary when considering period for State review of development plans is to suspend leases between the exploration and development phases. This could allow a longer period for review of development plans

than is provided for under the new regulation. This potentially prolonged period of review might be beneficial where the plans involve onshore facilities, such as pipeline landing sites and onshore support facilities, the ultimate approval of which would be within the jurisdiction of the State. State and local officials have expressed the view that they would be forced to make hasty and ill-informed decisions regarding potential onshore facilities without such a review period. Customary suspension between exploratory and development phases could provide a more orderly and efficient procedure for Federal and State decisions concerning those potential offshore and onshore aspects of OCS lease development within the exclusive or concurrent jurisdiction of the respective governments.

On the other hand, the adoption of a period of suspension between the exploration and development stages would result in a longer period of delay in initiating potential development operations. Delays increase costs to the operator which might be passed on to the consumer; it is possible that in marginal fields, lengthy delays might preclude production of the oil and gas, depending on the price of oil at the time.

Furthermore, before ordering a suspension of operations as described above, the Secretary would have to show that the suspension is in the interest of conservation of natural resources, as contemplated by Section 5(a) of the OCS Lands Act of 1953 (43 U.S.C. 1334(a)).

Also, for the suspension to be legally supportable, it must hold promise of the right of development at some future time. If the Secretary, in certain circumstances, should decide that public interest requires termination of an OCS lease at the end of the exploratory phase, he would be unable to cancel the lease without enactment of special legislation by Congress. This legislation might take the form of either separate leases for exploration and then development, or exploration with the possibility of lease termination at the discretion of the Secretary before development can occur. Since the results from these legislative alternatives are not known, we cannot say more than without incentives to take risk, petroleum companies may reduce the amount and number of bids for leases or they may not bid at all.

The suspension of operations could be for a period of three or four months to provide for even longer review of and comment than now established by the new regulation on a development plan by a State Governor. Other time periods for State review are possible. If the Secretary adopted this alternative, he could decide to provide for a review and comment period of six months or longer. In a different context, a period of six months has been provided under the Coastal Zone Management Act of 1972 (16 U.S.C. 1451-1464), to a State with a Federally-approved coastal zone management program to indicate whether or not it concurs with a certification by an applicant for a Federal permit subject to the Act, that a proposed activity is consistent with said program.

If the Secretary should decide to provide for a six-month period or longer for such review and comment on a development plan, there could be a longer corresponding delay between potential exploration activities and potential development activities on any OCS leases which might be issued. As stated above, lengthy delays could increase costs of oil and gas, and eliminate production of marginal fields depending on the economic situation.

Another alternative available to the Secretary is to require a plan of development to include more comprehensive information than required in the new regulation. The plan could be required to include such additional information on the following: (1) the number and bottom hole locations of wells to be drilled from each platform; (2) all abnormal pressure maps; (4) all information on shallow hazards; (4) anticipated disposition of all produced hydrocarbons; and (5) an environmental assessment of all potential offshore and onshore impacts of the operations described in the specific plan of development. This information would give States a more specific indication of the magnitude of anticipated production and resulting impacts. The

problem is that it would require lessees to divulge privileged information and might ultimately discourage the exploratory development and production of oil and gas resources on the OCS.

If it is determined that approval of a plan of development involves a major Federal action significantly affecting the quality of the human environment, and if the action has not been covered previously in an environmental impact statement, an EIS would be prepared in accordance with Section 102(2)(C) of the National Environmental Policy Act of 1969 before taking action on a request for approval of the development plan.

In summary, the adoption of one of these alternatives to the new 30 CFR 250.34 regulation could allow for an even more orderly and comprehensive review of plans of development than that established under the new regulation itself. Additional time would be allowed for more cooperation and coordination between Federal and State Governments in making decisions which bear upon those aspects of potential OCS operations and siting of facilities within the exclusive or concurrent jurisdiction of said governments.

A greater period of delay in securing potential development of OCS oil and gas resources and consequent delay in channeling such production into the domestic supply of energy could occur depending upon the duration of the suspension period. While a period of three, four, or six months or longer for State review and comment might be provided, it is not possible to predict the additional period of time that

might be involved in the evaluation of indepth State comments and potential efforts of the parties to resolve any differences that might arise.

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